Axolotl Response to:

Arkansas Health Information Exchange, Request for Information

Health Information Exchange. It's About Time.

Arkansas Health Information Exchange

Mandatory Response Requirements

1. Name and Category of Respondent

Company Name	Axolotl Corp
Address	160 W Santa Clara St, Suite 1000, San Jose, CA 95113
Category	Software vendor

2. Name of Vendor Representative

Contact name	Edie Hagens
Contact title	Sales Director, Southeastern USA
Contact telephone number	Office 408-920-0800x209 Mobile 214-621-3326
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See Appendix A for general vendor background and corporate information.

3. Summary Description of Solution

Axolotl Corp. is pleased to submit this response to Arkansas State Health Alliance for Records Exchange (SHARE) for Arkansas's Health Information Exchange RFI. As we hope you will agree, we humbly submit that Axolotl brings an unmatched offering of HIE experience, proven solutions and services, and best practices. We believe our unparalleled state, regional, and hospital-based HIE experience, flexible deployment configurations and quick speed to value will help SHARE meet its proposed goals. Axolotl's open, proven Elysium Exchange HIE solution, which incorporates and follows the latest standards and certifications according to IHE, HITSP, CCHIT and the NHIN, ensures that Arkansas will have a robust, interoperable system to meet today's and tomorrow's needs.

Axolotl Corp. has been providing communities, hospitals, and large health systems with web-based services to electronically exchange and distribute clinical information since 1995. Since inception,

Axolotl has continuously expanded its clinical collaboration and data management offerings to meet the diverse and changing needs of today's healthcare communities. As a result, Axolotl is recognized by the KLAS 2010 HIE (multi-stakeholder) Performance Report[1] and other healthcare HIE associations as a leader in the Health Information Exchange (HIE) industry.

Axolotl currently provides the solutions and services for three operational statewide HIEs: Utah, Nebraska and Idaho. Also, at present we are constructing a statewide HIE in New York, both building key portions of the SHIN-NY Enterprise Service Bus as well as operating four regional HIEs in the state. In addition, Axolotl has recently partnered with Chesapeake Regional Information System for our Patients (CRISP) to provide state-wide HIE services to the state of Maryland. Axolotl's experience with a wide variety of HIE initiatives has exposed the key factors to success, such as connecting state-level institutions and data sources (Public Health, Medicaid, Immunization and other registries, etc.); providing shared services that all regional HIEs can utilize; and providing inter-HIE connectivity at regional, statewide and nationwide levels.

Elysium Exchange is a sophisticated suite of applications that clinically connects all health care providers and organizations in a medical trading area, region or state. Axolotl's solutions are offered as a service (SaaS), providing customers with an affordable, secure HIE solution that is easily implemented and maintained. Existing and new critical applications easily connect to an HIE via exposed web services offered through Elysium Open Access - Axolotl's service-oriented architecture (SOA), bringing speed to value while simplifying implementation and reducing associated costs.

Elysium Exchange Framework includes all the technology needed for health information exchange (HIE) including identity management, interoperability, consumer preferences, clinical results delivery, aggregation services and security.

- **Elysium Patient Index (MPI)** uses Patient Identity and Record Locator Services (RLS) to find patient-related data across multiple sources in a federated HIE architecture.
- **Elysium Directory** manages the entry, authentication, and authorization of users and entities, and defines every participant's access privileges.
- **Elysium Interoperability Hub (I-HUB™)** clinically networks disparate, certified EMRs and legacy systems, enabling complete interoperability and fully collaborative patient care via HL7, CCR, CCD and other structures.
- **Elysium Usage Analyzer** is a sophisticated HIPAA-compliant reporting tool that provides institutions with an easy mechanism to audit all Elysium web-access activities and to track patterns of usage.
- **Elysium Personal Health Record Gateway** interfaces with standards- based PHRs.

[1] http://www.ihealthbeat.org/articles/2010/2/9/report-few-ehr-vendors-lead-in-health-data-exchange-arena.aspx

- **Security** is enforced at many levels: Technology such as VPN tunnels, SSL encryption, and WS-Security protect private health information as it is exchanged between health care partners; A robust role-based security system with configurable access controls enforces appropriate system authentication, authorization, and access; Enhanced reporting ensures users meet all requirements necessary as deemed by HIPAA, CCHIT, HHS, ONC, ARRA, and local privacy regulations.

Elysium EdgeServices connect an organization's interfaced health information systems to the Elysium Exchange Framework. EdgeServices maximize IT infrastructure investments by protecting facility systems from HIE queries, while maintaining the entity as the custodian of its data. Using messages from HIE participant data sources, EdgeServices provide a single gateway to the entire exchange, avoiding the need for expensive and time-intensive point-to-point connections to physicians. Patient data is automatically pushed to ordering providers' EMRs and, with patient consent, are made accessible to authorized users throughout the exchange.

Elysium Virtual Health Record (VHR) retrieves and displays patient information from HIE participant repositories.

Though it is not a specific requirement of the RFI, Axolotl also offers **Elysium EMR**, a CCHIT Certified® 2008, web-based Ambulatory EHR and web-based solution that connects physicians without their own EMRs for secure, electronic communication and collaboration while providing standard EMR capabilities.

A Flexible Solution

Axolotl recognizes that the Arkansas infrastructure will need to serve a diverse population of users: rural, independent physicians, IDNs, established RHIOs and other organizations that will benefit from health information exchange. To that end, Axolotl offers an equally diverse and flexible set of services that will help SHARE establish an HIE that meets the varied demands of the many stakeholders throughout the state.

Axolotl focuses on driving value throughout the HIE by providing a suite of services to best meet the needs and requirements of the various parties: State, stakeholders and users.

- **Critical Access/rural area MTAs that have no HIE**
  - Shared HIE Framework
  - Clinical Messaging and EMR interoperability
  - Community wide record
  - Elysium EMR ($70 a month)
  - Inter-HIE sharing (via CCD exchange or viewer)
  - Reporting (public health, registries, etc.)
  - Services (governance, planning, etc.

- **IDNs with "proprietary" HIEs**
  - Inter-HIE sharing (via CCD exchange or viewer)
  - Reporting (public health, registries, etc.)
  - Supplement any gaps in service

- **RHIOs that have an HIE**
  - Inter-HIE sharing (via CCD exchange or viewer)
  - Reporting (public health, registries, etc.)
  - Supplement any gaps in service

- **RHIOs that do not have an HIE**
  - Shared HIE Framework
  - Clinical Messaging and EMR interoperability
  - Community wide record
  - Elysium EMR
  - Inter-HIE sharing (via CCD exchange or viewer)
  - Reporting (public health, registries, etc.)

The above represents a full suite of services to enable health information exchange regardless of the level of sophistication currently achieved by the various Arkansas health care providers.

4. List of Current Installed Locations

Axolotl is the leading HIE vendor in the US, and has between 40% and 60% of the market share of multi-stakeholder RHIOs, and approximately 20% of health system/IDN HIEs. Axolotl is aware of no other vendor that has more than four multi-stakeholder HIEs as customers, whereas Axolotl has thirteen. Additionally, the eHealth Initiative ranks HIEs by stages, one through seven, where seven represents active, mature and successful HIEs that are expanding with additional participants. Axolotl counts approximately 30% of those stage-seven HIEs as its customers. Axolotl also counts three entire state HIEs as its customers (with a fourth recently signed), in addition to many regional HIEs in New York State who with other regions collectively make up the Statewide Health Information Network of New York.

Client Name	Location	Multi-stakeholder or single system / IDN HIE	Contract Began	Contract Ended
Santa Cruz HIE	Santa Cruz, CA	Multi-stakeholder	1996	Contract Active
HealthBridge	Cincinnati, OH	Multi-stakeholder	2005	Contract

				Active
Quality Health Network	Grand Junction, CO	Multi-stakeholder	2005	Contract Active
Utah Health Information Network	State of Utah	Multi-stakeholder	2009	Contract Active
Nebraska Health Information Initiative	State of Nebraska	Multi-stakeholder	2008	Contract Active
Idaho Health Data Exchange	State of Idaho	Multi-stakeholder	2008	Contract Active
State Health Information Network - NY	State of NY	Multi-stakeholder	2009	Contract Active
Chesapeake Regional Information System for our Patients	State of Maryland	Multi-stakeholder	2010	Contract Active
Greater Rochester RHIO	Rochester, NY	Multi-stakeholder	2006	Contract Active
Western NY HEALTHeLINK	Buffalo, NY	Multi-stakeholder	2007	Contract Active
Interboro RHIO	Queens, NY	Multi-stakeholder	2007	Contract Active
Capital Area RHIO	Capital Area, MI	Multi-stakeholder	2009	Contract Active
Michiana Health Information Network	Michiana, IN	Multi-stakeholder	2006	Contract Active
Bronx RHIO	Bronx, NY	Multi-stakeholder	2009	Contract Active
HealthLINC	Bloomington, IN	Multi-stakeholder	2007	Contract Active
CCHIE	Clark County, OH	Multi-stakeholder	2007	Contract Active
HAC-CNY	Syracuse, NY	Multi-stakeholder	2010	Contract Active
East Texas	Tyler, TX	Single system / IDN	2000	Contract

Medical Center				Active
Franciscan (CHI) Health	Tacoma, WA	Single system / IDN	2000	Contract Active
Mercy Health (CHW)	Sacramento, CA	Single system / IDN	1999	Contract Active
Clara Maass (St. Barnabas)	Belleville, NJ	Single system / IDN	2009	Contract Active
St. Johns Health	Anderson, IN	Single system / IDN	1999	Contract Active
Danbury Health	Danbury, CT	Single system / IDN	2008	Contract Active
Memorial Healthcare	Broward, FL	Single system / IDN	2009	Contract Active
Centegra Health System	NW Chicago, IL	Single system / IDN	2010	Contract Active

5. Estimate of implementation timeline

Every project timeline is unique due to the specific requirements and the general dynamics of an implementation. Typically, the average implementation time is 6 months. The elements of any implementation are described below:

Core Infrastructure Roll Out

The Axolotl suite of applications is proven and hardened over many implementations and is the most used solution for HIE in the country. It is highly configurable and adaptable, and as such, it is already inherently risk free as a technology solution. Therefore, assuming commitment of the stakeholders and an experienced SHARE team, there remain only a few technology and implementation variables that need be managed throughout the project life.

A timely implementation is dependent upon numerous data providers being able to produce data from their legacy systems when required. To obtain an understanding of when and how each hospital, reference lab, radiology center and payer system will be able to supply their data, it is an important project planning step to survey and inventory the data sources. Mitigating risks of overall deployment delays requires contingency planning for data sources not being able to meet their committed timeframes, enabling the plan to insert alternate data sources in that particular phase. The project managers from both the HIE and the technology vendor should regularly communicate with key personnel from the upcoming phase of data sources to ensure they are keeping to their timelines, thereby having plenty of warning when some inevitably slip.

Integration Specification Documentation

While the practice of creating an integration specification document for integrating with specific clients has not been undertaken in the past, there is no reason that this kind of documentation cannot occur as the solution is implemented. Generally speaking, the specifications provided to additional stakeholders or external HIEs are in line with the data structure standards and exchange protocols that are leveraged as much as possible within Elysium Exchange. Should any deviation from these standards occur, it may be documented and saved as a specification document that is specific to the Arkansas HIE.

Implementation Project Staffing

Axolotl knows that the success of the Arkansas HIE is heavily influenced by the experience and support of your partner professionals. To that end, Axolotl commits to SHARE an experienced, knowledgeable, and focused team comprised of an executive sponsor, a project manager, a systems engineer, a data analyst, and a systems specialist. The project manager will manage the implementation, and is responsible to the Axolotl Executive sponsor for all implementation project activities. Relevant activities include (but are not limited to) the following: to build relationships in the Arkansas community that will support the initiative, to assist SHARE in advocating the solution with stakeholders to support adoption, to work collaboratively with all data center staff wherever the system is hosted, to maintain regular and frequent communication with SHARE lead personnel, to oversee and integrate the work of Axolotl's technical and engineering teams, to participate in management reviews of contract deliverables, and to lead communication, documentation control, and reporting between SHARE leadership and Axolotl.

- The Axolotl Executive Sponsor, who is ultimately responsible for Axolotl's successful partnership with Inland Empire. This executive will oversee the Axolotl team ensuring that strategic and tactical goals are being met, and will be available to your Steering Committee and Leadership Teams as needed, including on-site, to assist with issues such as building stakeholder value, governance, etc.
- The Project Manager, who will oversee and integrate the work of three Axolotl teams based in San Jose and available to travel to Arkansas as required to support the development and implementation of Elysium.
    - The Technical Operations Team includes system and network administration, some aspects of second-level customer technical support, and system performance monitoring. A staff of server, network, security and interface engineers makes up this team.
    - The Applications Engineering and Deployment Team is responsible for overall implementation including training and account technical services and consists of junior and senior Elysium System Engineers and other Elysium specialists.

- The Research and Development Team is responsible for significant product changes, new features, and customizations. Inland Empire users and managers will participate in the activities of this team by providing input on requirements and functional specifications and by reviewing all work produced.

The Project Manager will be supported by three key professionals as follows:

- Elysium System Engineer, responsible for developing software solutions and providing high-level technical services for Inland Empire.
- Elysium Data Administrator, responsible for database management and analysis support during testing phase and the initial phase of production data flow.
- Elysium Implementation Specialist, who will provide support for implementation including education and training and physician practice workflow analysis.

Arkansas HIE Staffing

As a hosted SaaS solution, the staffing requirements to run and operate an HIE are minimized. There are various one-time efforts necessary by associated hospital staff as detailed below, as well as ongoing staff necessary for help desk, training and promotion/marketing. While Axolotl can provide first line help desk and training, it has been found most effective to provide train the trainer services so local hospital staff can provide the necessary manpower and hands on assistance. From a high level perspective, Arkansas will need an executive sponsor, project manager, and interface analyst, a lab technician, a data administrator, a physician liaison, an internal trainer, and internal help desk staff.

Role / Site	Function	Commitment
Executive Sponsor / HIE	Senior leadership backing the project. Should have the ability to engage key physicians and maneuver around political road blocks. Should be from the "C" suite, preferably CMO or CMIO.	8 hours/week for the first year of the project, reduced to 2 or 4 hours a week thereafter.
Project Manager / HIE	Will coordinate with Axolotl project manager to drive project to completion. Should be a project manager from HIE IT department.	16 hours/week until all physicians and data sources in production, thereafter 8 hours per week until steady state.
Interface Analyst / HIE	Will work with Axolotl personnel to aid in establishing hospital data feeds and verifying accuracy of Elysium output.	10 hours/week for 12 weeks.
Lab Technician / HIE	Will work with Axolotl personnel to perform LOINC coding of key 150 lab	8 hours for 150 codes. More time to complete additional

	analytics.	cross reference table.
Data Administrator / HIE	Will work with Axolotl staff when data errors occur from source system. Usually an IT staff member.	Approximately 2 hours per week depending on data quality.
Physician Liaison / HIE	Will evangelize the project with employed and affiliated physicians. Should utilize marketing or outreach department personnel.	16 hours/week until all physicians in production, thereafter 8 hours per week as part of their normal duties.
Trainer / HIE	Will work with physicians, office staff and other users to learn the system. Should use existing application training resource from IT. Will be trained extensively by Axolotl trainers.	Approximately 1 FTE per 1000 physician users.
Help Desk / HIE	Will provide basic support via phone and email for the application for end users. Should utilize pool of existing hospital help desk staff. Will be trained extensively by Axolotl trainers.	Approximately 1 FTE per 500 physician users.
Office Champion / Physician Practice	Will be the "go to" expert in the practice, and will train when there is staff turnover. Office manager, medical assistant or tech savvy physician.	Attend four one-hour training sessions.
End User / Physician Practice	User of the Elysium system.	Attend two one-hour training sessions.

Testing and Implementation Processes

Axolotl thoroughly tests all changes made to Elysium Exchange systems. This includes both development changes, and implementation adjustments to existing data feeds. See the table below for specific testing activities during the implementation process.

Below is a description of technical tasks, responsibilities, and time frames for data system interface tasks to provide an idea of the process.

***Elysium* Data Source Technical Work Effort**		
Connectivity	Staff	Est. Time
VPN Questionnaire Sent / Received – standard form sent to data providers for new VPN connections. User fills out and returns to Axolotl	Network Analyst	.5 hours
Connectivity – establish IP address for data feed. Axolotl will	Network Analyst	.5 hours

assign test ports, one for admissions discharges and transfers (ADT), one for lab results (LAB), one for radiology results (RAD) and one for transcribed reports (TRN)		
Connectivity Tested – after VPN is set up, troubleshooting if necessary	Network Analyst	.5 hours
Result Interfaces	Staff	Est. Time
Data Volume Projection – estimate of how many daily transactions by feed are currently being processed by feed, lab, radiology, transcription, ADT. For lab please note if count is by OBR or OBX. For ADT please break down by A04, A08 and all others	Clinical Analyst	.5 hours
Data in HL7 – do you provide HL7, what version, what message types (ORU, ADT, MDM, etc)	Interface Analyst	.5 hours
Interface Type – method of transfer to Axolotl - TCP socket, FTP, etc	Interface Analyst	.5 hours
Axolotl HL7 Spec Provided – Axolotl sends HL7 specs for inbound messages for review	Interface Analyst	.5 hours
Data Provider HL7 Spec Obtained – data provider sends HL7 specs for outbound messages for Axolotl to review	Interface Analyst	.5 hours
Sample Data – data provider provide test data in either a zip file or through the VPN connection (VPN preferred) ADT - admissions discharges and transfers LAB – textual, pathology and micro and numeric RAD – radiology results TRN – transcribed reports, (H&P, ED Reports, OP notes, consults, discharge summaries, etc.)	Interface Analyst	1 hour per feed
HL7 Map Ready – Axolotl builds the first iteration of the Mercator map based on sample data provide, one map per feed	Axolotl	
Map Sample Data – process sample data through Mercator map to Elysium, sample data is displayed through Elysium EMR in test databases per feed	Axolotl	
Review Sample results – Axolotl performs the first review of sample data for correct formatting and display	Clinical Analyst	4 – 6 hours
Data Analysis – Axolotl works with data provider to perform QA review and input, reformatting of data until agreed on	Clinical Analyst	4 – 6 hours

output		
Data Translation and Database Building	Staff	Est. Time
LOINC Coding - LOINC Codes Provided – is the data provider able to provide LOINC Codes in lab HL7 messages LOINC training and Coding – if the data provider cannot provide LOINC Codes in lab HL7 messages Axolotl will build a look up table to insert the LOINC code based on the local code passed in the HL7 message Axolotl 139 LOINC Code Provided – Axolotl will provide a spreadsheet listing the top 139 LOINC codes for the data provider to assign a local code for use in the look up table	Clinical Analyst, Clinical Director	2 – 4 hours for adding local codes to the LOINC Codes spreadsheet
ADT Bulk Load – typically preloading of ADT data from providers, recommended that data provider runs file merging before submitting data	Interface Analyst	2 – 4 hours
Building the Physician Address Book (PAB) in Elysium, PAB bulk load – the data provider provides a copy of the physician directory in a spreadsheet or csv with the following data fields: Physician; first, MI, last, title, LUID (local user ID), specialty, NPI, Office/Practice; name, address, city, state, ZIP code, phone and fax	Clinical Analyst or Interface Analyst	2 – 4 hours
Result Processing and Testing	Staff	Est. Time
ACK/NACK Acknowledgements – Confirmation between provider and Axolotl that "X" number of messages were sent and received	Interface Analyst	1 hour
Error Detection and Reporting – Axolotl identifies errors preventing messages from processing through Elysium interface and works with provider to resolve	Interface Analyst	1 – 2 hours per feed if required
Review Data Maps – Axolotl adjusts interface mapping to present data in the Elysium required fields. If the provider requests to make changes in their engine before sending messages Axolotl will forward the changes	Interface Analyst	1 – 2 hours per feed if required
Test Interface Maps with Test Data - Axolotl builds the first iteration of the Mercator map based on sample data provide, one map per feed. Axolotl performs the first review of test data for correct formatting and display. This is a test platform, production data can be used.	Axolotl	

Display Test Data in Elysium for QA review - process test data through Mercator map to Elysium, sample data is displayed through Elysium EMR in test databases ADT - admissions discharges and transfers LAB – textual, pathology and micro and numeric RAD – radiology results TRN – transcribed reports	Clinical Analyst	2 – 6 hours per feed
Sign off on test feeds - data provider signs off on test data formatting	Clinical Analyst	1 hour
Check MPI Administration and Merge functionality – data provider and Axolotl analysis of multiple MPI bulk loads for duplicates and merging of patient records	Clinical or Interface Analyst	1 – 2 hours
Check ADT Update of the MPI – data provider and Axolotl analysis of MPI updating from ADT feeds for duplicates, creating new records and merging of patient records	Clinical or Interface Analyst	1 – 2 hours
Check Physician Address Book routing on LUID only – data provider and Axolotl analysis of PAB and routing of results based on facility ID and LUID	Clinical or Interface Analyst	1 – 2 hours
Production Processing and Testing	Staff	Est. Time
Provider QA review – physician practice runs parallel processes of existing results delivery versus electronic to validate receiving all results, usually two to five days. Data provider runs QA test versus live data, one to two days ADT - admissions discharges and transfers LAB – textual, pathology and micro and numeric RAD – radiology results TRN – transcribed reports, H7P, OP notes, consults, ED Reports, etc.	Clinical Analyst	2 – 6 hours per feed
Updates – Method – after feeds are live, review data to determine which feeds and fields should update the MPI	Interface Analyst	1 – 2 hours
Physician Sign Off – after physician practice runs parallel process, practice signs off on getting results electronically through Elysium. Data provider must be able to stop their current results delivery process by physician.	Clinical Analyst or Interface Analyst	1 hour

As a reference, shown below is a sample implementation project plan

1	**1 Regional HIE**	**71.75 days**		**Thu 4/1/10**	**Fri 11/26/10**	
2	**1.1 Begin Phase 1a HIE Implementation**	**71.75 days**		**Thu 4/1/10**	**Fri 11/26/10**	
3	**1.1.1 Planning for Infrastructure and System Design**	**20.75 days**		**Thu 4/1/10**	**Thu 4/29/10**	
4	**1.1.1.1 Review Statement of Work for Implementation**	**20.75 days**		**Thu 4/1/10**	**Thu 4/29/10**	
5	1.1.1.1.1 Review Deliverables for Implementation SOW	0.5 days		Thu 4/1/10	Thu 4/1/10	RHIO,AX
6	**1.1.1.1.2 Teams and Logistics**	**20.75 days**		**Thu 4/1/10**	**Thu 4/29/10**	
7	**1.1.1.1.2.1 Define/Establish Criteria for Success**	**3.25 days**		**Thu 4/1/10**	**Tue 4/6/10**	
8	1.1.1.1.2.1.1 Indentify Deliverable Dependencies for Implementation	1 day	22	Mon 4/5/10	Tue 4/6/10	RHIO,AX
9	1.1.1.1.2.1.2 Establish/review Mtg Schedules	1 day	5	Thu 4/1/10	Fri 4/2/10	RHIO,AX
10	**1.1.1.1.2.2 Define Support Model**	**4 days**		**Thu 4/1/10**	**Tue 4/6/10**	
11	1.1.1.1.2.2.1 Elysium ASP Support	0.25 days	7	Tue 4/6/10	Tue 4/6/10	RHIO,AX
12	**1.1.1.1.2.2.2 HIE Support**	**0.25 days**		**Thu 4/1/10**	**Thu 4/1/10**	
13	1.1.1.1.2.2.2.1 Elysium Administration	0.25 days		Thu 4/1/10	Thu 4/1/10	RHIO,AX
14	1.1.1.1.2.2.2.2 VHR Administration	0.25 days		Thu 4/1/10	Thu 4/1/10	RHIO,AX
15	1.1.1.1.2.3 Define User Training	1 day		Thu 4/1/10	Thu 4/1/10	RHIO,AX
16	1.1.1.1.2.4 Define Other Roles, Including Hospital Technical Resources	1 day		Thu 4/1/10	Thu 4/1/10	RHIO,AX
17	**1.1.1.1.2.5 MPI Administration**	**0.25 days**		**Thu 4/1/10**	**Thu 4/1/10**	
18	1.1.1.1.2.5.1 Review Staff allocation	0.25 days	13	Thu 4/1/10	Thu 4/1/10	RHIO,AX
19	**1.1.1.1.2.6 Select data providers that will be participating**	**20.25 days**		**Thu 4/1/10**	**Thu 4/29/10**	
20	1.1.1.1.2.6.1 Hospitals and other Data Providers	0.25 days	5	Thu 4/1/10	Thu 4/1/10	RHIO,AX
21	1.1.1.1.2.6.2 Get All Agreements signed (data sharing, confidentiality, etc)	20 days	20	Thu 4/1/10	Thu 4/29/10	RHIO,AX
22	**1.1.1.1.2.6.3 Readiness Assessment of Data Systems**	**2 days**		**Thu 4/1/10**	**Mon 4/5/10**	
23	**1.1.1.1.2.6.3.1 Assessment of typical CDO Data Source Systems**	**2 days**	**20**	**Thu 4/1/10**	**Mon 4/5/10**	
24	1.1.1.1.2.6.3.1.1 Hospital A	0.67 days	20	Thu 4/1/10	Fri 4/2/10	RHIO,AX,Data Provider
25	1.1.1.1.2.6.3.1.2 Hospital B	0.67 days	24	Fri 4/2/10	Mon 4/5/10	RHIO,AX,Data Provider
26	1.1.1.1.2.6.3.1.3 Hospital C	0.67 days	25	Mon 4/5/10	Mon 4/5/10	RHIO,AX,Data Provider
27	1.1.1.1.2.7 Define Privacy and Security: user roles, information access, etc.	5 days	5	Thu 4/1/10	Thu 4/8/10	RHIO,AX
28	**1.1.1.1.2.8 Select health care providers and physician groups that will be participating**	**10 days**		**Thu 4/1/10**	**Thu 4/15/10**	
29	1.1.1.1.2.8.1 Health Care Providers - nursing homes, public health, home care, clinics	10 days	5	Thu 4/1/10	Thu 4/15/10	RHIO,AX
30	1.1.1.1.2.8.2 VHR Users	10 days	5	Thu 4/1/10	Thu 4/15/10	RHIO,AX
31	1.1.1.1.2.8.3 Third-party EMR users	10 days	5	Thu 4/1/10	Thu 4/15/10	RHIO,AX
32	1.1.1.1.2.8.4 Elysium Full-Featured Clinical Messaging plus eRx	10 days	5	Thu 4/1/10	Thu 4/15/10	RHIO,AX
33	**1.1.1.2 Domino Planning**	**7.5 days**		**Thu 4/1/10**	**Mon 4/12/10**	
34	1.1.1.2.1 Define Type of Network	1 day	5	Thu 4/1/10	Fri 4/2/10	RHIO,AX

Support

Axolotl has a standard customer service support policy, which ensures that issues are appropriately received, responded to, escalated, and resolved in timely fashions. Axolotl support staff are available 24/7/365 to respond to potential issues. Additional support may be provided by additional Axolotl teams (e.g. Implementation, Technical Operations) during specific projects or times of need. All Axolotl clients are supported by a single, centralized support team. Typically, Axolotl clients provide first level support to end users, and contact Axolotl support for second tier support issues.

All clients are supported by a single centrally managed support office. Additional support personnel are hired as additional business requires. Support staff may also receive assistance from technical operations, implementation, and application development engineers as high priority or subject specific support instances occur.

Axolotl support staff respond to issues 24/7/365 by phone, email, and customer CRM portal log in. The CRM portal provides tools for issue ticketing, response, tracking, and resolution.

Support Response Times

When reporting a problem, it is important to be clear about the severity of the issue so that the impact is fully understood by the Technical support engineers. Care should be taken in suggesting a priority for the problem; the table below provides some guidelines. In appropriately assigned priorities will be adjusted and may result in a delay in resolution:

Priority	Description
Holding up Production	A problem which renders the system non-operational and for which there is no work around.
Very High	A problem which is causing extreme inconvenience to multiple users or installations but which is not preventing operation.
High	A problem which consistently causes inconvenience to some users or installations but for which a reasonable work around exists.
Normal	A problem which sometimes causes inconvenience to some users or installations but for which a reasonable work around exists.
Low	A problem which rarely causes inconvenience to any user or installation and for which a reasonable work around exists.
Very Low	A problem which causes no inconvenience to any users.

Prior to submitting a Technical support request, the End User support team should collect relevant background information and details regarding the issue, ideally sufficient information to ensure the problem is reproducible. Also, since there may be fees associated with work on support requests that involve customizations or non-Axolotl problems, it is recommended that your End User support team thoroughly explore an issue before submitting a Technical support request.

Technical support Request Processing

When a new Technical support request arrives at Axolotl, an acknowledging receipt will be delivered back to the sender. If such an acknowledging response is not received in a timely manner, your End User support team may want to follow up via phone, fax or email to ensure that the request was received and logged.

Each Technical support request is reviewed and assigned to a specific support engineer. That engineer will quickly research the problem with the objective of confirming that the problem is

reproducible in a standard Elysium configuration and will assess and confirm the general impact, magnitude and priority of the issue.

Axolotl engineers normally work on Technical support requests during regular Axolotl Business Hours unless the problem is of the highest severity or you have contracted for Axolotl to provide extended technical support. Axolotl business hours are weekdays between the hours of 8:30 am and 5:30 pm Pacific Time except holidays.

If Axolotl determines that a particular issue is a product or service defect, our engineering department will either quickly provide a fix or will respond with a commitment to provide the fix in a future product release. The decision regarding which of these is appropriate is made by Axolotl's Elysium Product Management Team based on the degree to which the problem interferes with production processing and the availability of potential short-term workarounds.
Support Requests are considered "Completed" for a number of reasons including:

- A software fix addressing the problem has been provided to the customer or directly applied to the production processing environment,
- A work-around has been provided to address short-term operations and a commitment has been made to deliver a longer term fix in a future product release,
- The customer has requested Axolotl to stop work on the issue

Training

There is a direct correlation between dedicated training and the successful use of Elysium. The Axolotl training team has refined the training process based on years of successful implementations. The importance of training cannot be overstated. The goal of the training program is for you to accurately document patient encounters in Elysium on the first day of go-live. The majority of our clients are able to see their normal patient load within a few short weeks after go-live and can maximize the workflow and efficiency of the practice.

Web-based Training (WBT)/Learning Management System (LMS)
Axolotl offers Web-based Training. Web-based Training is a self-paced set of courses for end-users of the clinical applications. WBT/LMS Training does not replace instructor led training. It is used as a tool to improve the effectiveness of the implementation of Elysium Software.

The Learning Management System (LMS) allows administrators to apply the following training programs, classroom and online events, e-learning programs and training content:

- Administration
- Documentation
- Tracking

- Reporting

Workflow Assessment/Office Efficiency
A work flow assessment is performed by a implementation specialist for each office. The implementation specialist will work closely with the Office Manager/Administrator and each provider to asses and understand his or her practice patterns. To maximize the utilization of Elysium and determine the best workflow(s), the implementation specialist will:

- Conduct a site assessment.
- Determine IT requirements and capabilities.
- Review and map current work flow.
- Gather key forms, templates, and letters for future integration.
- Establish Elysium auto-processing rules to improve current workflow.

Elysium Administrative and Technical Training
An appropriate Axolotl implementation staff member will provide the HIE administrative staff the knowledge to build and maintain a Help Desk providing 1st and 2nd tier support to their end users. Also an appropriate Axolotl implementation staff will provide the HIE administrative staff the knowledge to provide necessary system maintenance training, and system maintenance (such as system level configuration option, etc...).

Super-User Training
Axolotl stresses the importance of training and therefore for larger practices we highly recommend that certain personnel be designated as a super-user. This super-user will receive intense, hands-on training. These super-users then will help Axolotl trainers in all phases of training. This super-user will

- Train an appropriate staff on reviewing results with awaiting action inbox.
- Train an appropriate staff on clinical messaging, tasking, and VHR access.

Phase I - Initial Training
Depending on the size of the office, training will take place over a two to three day period. The offices success with Elysium depends on the commitment each staff member puts forth.

Day 1

- Elysium VHR Basic
- Elysium EMR Lite Basic I
- Elysium EMR Lite Basic II

Day 2

- eRX

Day 3

- Elysium EMR Advance Features I-Patient Summary
- Elysium EMR Advance Features II-Printing & Auto Processing
- Elysium EMR Advance Features III-Merge and Identify

Hands-On With Elysium
As Phase I continues, staff members will be given access to Elysium to gain confidence with practice documenting patient encounters. The more access and practice the staff has with Elysium the greater comfort during go-live.

Day 4

- Practice Scenarios
- Test-Review-Questions
- Practice Sessions
- Questions

Phase II - On-Site Refresher Training
Axolotl's specialists return to meet with the staff members who have completed Phase I for a day of refresher training. In this phase the staff will have opportunity to have a Q & A session from the initial training. Advance features, tools and more hands on practice will be conducted to prepare for go-live.

Support Staff Training
The Axolotl implementation specialist will coordinate with the Office Manager/Administrator to train all members of the office support staff for a smooth transition to using the Elysium application.

Phase III - Go Live
An Axolotl Implementation specialist will be on site to support the provider(s) and staff with any post go-live questions and offer any additional training, if needed.

6. Description of the Financial Business Models

Axolotl offers its Elysium Exchange HIE solution as SaaS. SaaS is typically offered by subscription. In general, Axolotl's subscription prices for solution components vary by volume of physician users, number of data sources connected to the HIE and patient population.

Axolotl would be open to discussing alternative business models should SHARE be interested in an alternative approach.

7. Suggested Service Level Agreement

Generally speaking, Axolotl's Service Level Agreements guarantee a one second or less response time for most transactions, with no greater than an average response time of two seconds for transactions. These SLAs assume that the functionality / service being engaged should only take a second or two to respond. Axolotl will continue to commit to these SLAs for any services that do not require extensive or timely system processing in order to achieve the desired function.

8. Estimated Cost of Solution Components

As stated in section 3. Summary Description of Solution, Axolotl understands that SHARE will need to deploy an infrastructure in Arkansas to serve a diverse population of users: rural, independent physicians, IDNs, established RHIOs and other organizations that will benefit from health information exchange. Serving each of these HIE participants requires different services from the Axolotl solution portfolio.

Pricing for Elysium Exchange includes three distinct software components and services.

The core infrastructure described in the RFI would be provided by the Axolotl Elysium Exchange Framework. The Framework includes the following services and functions:

- EMPI
- Provider Directory
- Security – Authorization, auditing, granular permissions configuration
- Record Locator
- Document Services
- Semantic Interoperability
- SOA Platform
- Elysium Usage Analyzer, to audit security logs and monitor usage of the exchange
- SureScripts eRx Gateway

In addition, the following would also be included:

- PHR Gateway – connections from the exchange to Microsoft HealthVault and Google Health
- Connections to Lab Corp. and Quest Diagnostics
- Configuration of up to 5 Inter-HIE connections (NHIN-based configurations)
- 150 independent physician practice connections
- Immunization Gateway

Given the population of the State of Arkansas, the above package of functionality would be **$995,000** per year ASP fee with one time setup cost of **$497,500**. The $995,000 is a yearly fee, but keep in mind that Axolotl hosts the system, supports the system, handles all the typical hosting functions like high availability and backup and removes any infrastructure and hardware costs from the equation.

The above is the Elysium Exchange Framework, and it covers many of the central services that SHARE will want to offer throughout Arkansas.

In addition, there are two other typical costs: for bi-directional integration of large data providers and for end-user applications.

The cost to establish and maintain a connection to a large data provider like a hospital or reference lab ranges from **$25,000** per year to **$150,000** per year. There are one-time implementation fees associated with the hospital connection ranging from **$24,000 to $74,000**. Likewise, these services would be hosted by Axolotl and not require any hardware investments from the hospital.

The fee to connect physicians to the HIE is **$128 / year per physician**. This can be thought of as the cost to maintain an account in the system. Physicians may be connecting to the exchange through their own third-party ambulatory EMR or they may be using Axolotl's Elysium EMR which is mentioned below.

In addition, there is a **$128 / year per physician** fee for access to the Elysium Virtual Health Record, a web-based, aggregate, longitudinal view of patient data from across the HIE.

If SHARE wishes to offer it, Axolotl can also make the web-based, CCHIT '08 Certified Ambulatory EHR available. Elysium EMR offers clinical messaging, referrals, encounter recording, e-prescribing and e-ordering.

The base Elysium EMR is **$255 per physician per year**. Adding eRx would total **$403 per year** and adding Ordering would total **$879 per year**.

Summary of Services	Pricing
Elysium Framework, Gateways, Miscellaneous Services	
MPI, Provider Directory,Security, Record Locator, Document Services, Semantic Interoperability, SOA Platform, Elysium Usage Analyzer, Fax Server, Elysium Reporter	$995,000
I-Hub (Included Up to 150 practices), Rx Gateway, PHR Gateway, Immunization Gateway, Inter-HIE Gateway	Included
One-time Implementation	**$497,500**
EdgeServers (each)	**$25,000** to **$150,000** per year
One-time Implementation (each)	**$24,000 to $74,000**
Clinical Presentation Applications	
Named Physician Network Connections	$128 each/year
VHR Licenses	$128 each/year
Axolotl EMR Licenses	$255 each/year
Axolotl EMR Licenses with eRx	$403 each/year
Axolotl EMR Licenses with eRx and CPOE	$879 each/year

We hope that this has provided enough pricing information for SHARE, we would be happy to clarify any of this pricing information if needed.

General Solution Description

1. Interoperability

Interoperability can be defined as the ability of two or more systems or components to exchange information and to use the information that has been exchanged. Axolotl's Elysium Exchange HIE suite offers multiple components that offer the functionality to connect the various groups

listed below. In general, though, interoperability is accomplished via reliance and use of industry standards and through tools and processes gained through 15 years of HIE experience.

1. **Clinicians** (physicians, nurses, hospitals, clinics, laboratories, pharmacies) – Elysium VHR offers any authorized healthcare professional access to a patient longitudinal health record compiled from data from across the state. Elysium I-Hub interfaces directly with third-party ambulatory EMRs based in independent practices or in clinics, Elysium EdgeServers manage interfaces to large data providers like hospitals and laboratories, through Rx Gateway Axolotl offers access to the SureScripts network, Axolotl is a Gold Certified SureScripts partner.
2. **Citizens** (patients, consumers) – Axolotl offers a PHR Gateway to connect third-party PHRs like Google Health and Microsoft HealthVault to Elysium Exchange patient records.
3. **Public health** entities, including registries – Axolotl's Public Health Gateway manages interfacing with public health entities.
4. **Payers** (private and public) – Payer data can be exchanged in the typical method for large data providers (EdgeServers) or through the Elysium Open Access SOA Framework.

The solutions above are detailed below:

Elysium Virtual Health Record
Elysium Virtual Health Record retrieves and displays all data available for a patient from a variety of source systems through Web enabled queries and a customizable reporting tool kit. Data retrieval and display occurs via record locator services, gateways to internal and external entities (i.e. Surescripts, external HIEs), and Web services.

A patient's Virtual Health Record (VHR) is pulled together, virtually, to create an electronic health record that contains all available patient data across the continuum of care. Elysium gathers data from a variety of sources to bring together a patient's VHR, including Web service queries to external applications, EdgeServer and I-Hub data repositories, Encounter Data Store, patient index (or indices), and any other query able data source.. A patient's VHR can include admission records, discharge summaries, visit records, medication history, problem lists, allergies, up to date eligibility information, the results of all tests and exams ordered by clinicians, and any encounter notes, referrals and orders that exchange participants are willing to share. This information is displayed similar to a patient chart, with different result types filed under different virtual tabs. In some environments, Virtual Health Record users may select data from a patient's VHR and forward selected results to their chosen EMR or EMR Lite system (this feature is dependent on source system and exchange policies and configurations).

Beyond individual patient care, Virtual Health Record administration accounts can be created to view and manage results across an exchange. These users will have access to tabs that may contain all reports that meet selection criteria across an entire community. This capability grants

administrative staff the ability to easily audit and manage reports community wide. Useful examples of this feature include administrators resolving unidentified reports in repositories or viewing all recent admits or discharges for a hospital or community.

It should be noted that both user and administrator Virtual Health Record tabs are customizable. Tabs can display data based on selection criteria that may defined by complex formulas. The use of formulas allows extensive ability for tab customization to suit community, practice, and even individual user requirements.

Elysium I-Hub

Elysium I-Hub (Interoperability Hub) provides true interoperability through bi-directional exchange of HL7 and other clinical message types for users of disparate EHRs; referrals, labs, radiology reports, transcriptions, orders, and CCDs can all be exchanged.

Interoperability is defined as the ability of two or more systems or components to exchange information and to use the information that has been exchanged. There are a wide variety of architectures that will support the exchange of clinical information. The exchange can be a one-way "push" of information to authorized recipients, a "pull" or query of information from data repositories, or a bidirectional exchange of messages from one health care provider to another. Elysium I-Hub exists as a combination of databases and agents that provide both "push" and "pull" services to users of disparate systems. These databases are capable of receiving, translating, appending to, and exchanging a vast number of information standards, including HL7 v2.2+, HL7 v3, CDA, CCR, and CCD, potentially utilizing IHE profiles such as PIX, PDQ, and XDS.b. For "pull" services, I-Hub provides repository services for all data exchanged from an EMR practice. If a patient and practice elect to share data with the exchange, data that is processed can be saved to I-Hub repositories for future query (for more details, please see Elysium Repositories under Gateway Components). This repository data is made available to EMR users through IHE based Web services (PIX, PDQ, XDS.b), or to users of Elysium VHR through a record locator service. Through this seamless "push and pull" of data across systems, Elysium I-Hub bridges gaps in technology thereby improving the efficiency and quality of patient care.

While the advantages of seamless data exchange are clear, any health exchange system must balance the drive to interoperability through standards, with practical and proven technology. Elysium's I-Hub provides this balance as a proven, easily deployed component to get the most healthcare entities exchanging information as soon as possible.

Elysium EdgeServer

Elysium EdgeServer manages the transformation and distribution of data from systems such as legacy hospitals, lab systems, radiology systems, payers, and other regional information exchanges to Elysium. Elysium EdgeServers reside between source systems and an exchange as a collection of

gateway based databases and agents. Databases include a site and feed configuration database, an administration database, a log database, and a routing database.

Accurate and efficient results delivery is paramount to the success of an exchange. Elysium EdgeServer provides all necessary recipient identification and message delivery mediums required to achieve this accuracy. Results from source systems are transported via data feeds to Elysium EdgeServers. EdgeServers then perform a number of functions, including data transformation / standardization, provider lookup, and message routing according to provider preference –
Data transformation: EdgeServer services include the ability to take incoming data and turn it into standards-based data. Elysium EdgeServer takes source systems' clinical data in a wide array of formats, translates that data into a standard format, preserves original clinical content, and produces a consistent data store. Some of the standards compatible with EdgeServer include HL7 v2.2+, HL7 v3, CDA, CCR, and CCD. Translation may include the appendage of additional standards, such as LOINC codes to an HL7 file. EdgeServers are also responsible for storing repositories of clinical data from each data source (see Elysium Repository).

Provider lookup: once data has been standardized for delivery, EdgeServer needs to know where to send it. At this point, the EdgeServer will reference the Elysium Directory (see Framework Components) for the recipient provider (providers can be found by Physician ID # or by name). Assuming a provider is found, his preferred message delivery options are applied to the results for EdgeServer delivery.

Message routing: Messages move into Elysium, throughout Elysium, and to external applications based on sets of routing rules. To every extent possible the routing of messages is automatic, based on the contents of each message. Routing leverages include the Elysium Directory for user routing choices, the Elysium Patient Index for patient identity (if recommended Patient Identity and Management services are available), and both a configuration database and a routing rules database within Elysium EdgeServer. Through these components, Elysium ensures that appropriately standardized messages are routed, according to community and physician preferences, to the physician's desktop application of choice. Available delivery options include to Elysium EMR Lite, to any CCHIT certified EHR, to a fax machine, or to a printer. As results are delivered to providers, additional copies may be sent to clinical repositories for future query.

Elysium RxGateway
Elysium RxGateway provides Elysium's complete eRx solution with focus on the workflow surrounding the creation of prescriptions, refills, and renewals, as well as providing automated delivery to pharmacies. Elysium RxGateway's primary mode of delivery routes prescriptions from Elysium to SureScripts-RxHub, and from there to pharmacies. If e-delivery fails or is otherwise unavailable, Elysium Fax may automatically fax prescriptions to pharmacies.

In addition to creating and sending prescriptions, manual and automated entry of prescription refill requests is provided. Generally, refill requests arrive from two sources. The first is from a provider assistant or practice staff. These staff users are granted access to the e-prescribing component of the system, however they may only prepare and assign prescriptions for authorized physician approval, there is no ability to sign or send. The second source of refill requests is from pharmacies connected to SureScripts-RxHub. These pharmacies can send refill requests to exchange providers that are registered with SureScripts-RxHub. Upon receipt, SureScripts-RxHub will reference their provider listing, and route the refill request to the appropriate Elysium Exchange system for processing. Regardless of the source, refill requests are easily processed to provider inboxes for approval and transmission.

Beyond e-delivery of prescriptions and refill requests, there are many benefits to Elysium's RxGateway. Many Elysium HIE customers are supported financially by payers because it's understood that benefits and savings will accrue over time. These payers have worked with SureScripts-RxHub to allow provider access to patient eligibility, drug formularies, prescription fill history, and generic drug alternatives. In turn, the payer agenda is put at the physician's fingertips, and savings are experienced across the exchange. This eligibility information may be easily populated from manual or automatic queries to SureScripts-RxHub. These queries provide real time data on patient eligibility status, thereby simplifying billing processes tied to medication management.

In addition to eligibility queries, Elysium RxGateway provides the ability to query SureScripts-RxHub for patient medication history. Responses to these queries may be saved to the patient summary medication list. Medication lists in Elysium use the NDC coding in a database populated by Medispan data. Medications can be active or inactive. Any active medications will interact with Elysium Prescription Management system. This helps avoid the prescription of any drugs that may dangerously interact with a patient's current medication. Other drug interaction warnings are displayed for drug-allergy, drug-gender, and drug-age interactions. Medication allergies are populated through data entry by Elysium EMR Lite users, from fill history provided through SureScripts-RxHub, or from CCDs obtained from external sources. Bulk data uploads from payers can also be used to initially populate patient history.

Elysium RxGateway may be interfaced with or effectively replaced by other medication gateway applications, if required.

<u>For Citizens</u>

Elysium PHR Gateway

Axolotl does not provide its own patient portal product, however, as with other health information systems, Elysium Exchange may interface with any standards based PHR system. Axolotl's philosophy is that with the emergence of PHRs supplied by health plans and employers, not to mention Google and Microsoft, it is highly unlikely a single vendor PHR solution will

succeed. As such, similar to integration with any CCHIT or standards-based EMR, Axolotl is prepared to integrate with any suitable PHR.

It is imperative that some level of identity management and authentication services are built into the PHR or the portal that connects them so as to ensure any exchange of health data is assured to be by and for the patient purportedly using the PHR. Axolotl has partners that can be utilized to provide strong and/or two-factor authentication services at very reasonable prices. Axolotl has a current customer that is establishing third party PHR integration into an Elysium with two PHRs initially with plans to expand. This same customer has put up a Patient Portal website that enables the patients to submit their participation consents for data sharing as well as register a PHR if they are using it. Axolotl has also been involved in discussion with Google Health for deployment of Elysium-Google Health integration in existing Elysium HIEs, and we anticipate a pilot HIE to begin exchanging data with Google Health in the first half of 2010.

Public Health Gateway
Automated and manual services for public health reporting and other reporting services may be easily configured. Services include the automated routing of data that matches defined report conditions, the de-identification of results if desired / required, and manual and automated alerting services to HIE participants. Data may be routed to either the Elysium Reporting Hub, or to external registry and reporting applications (i.e. data warehouse, CDR) for public health reporting purposes. Should Clinical Decision Support rules be integrated with disease analysis, alerts may be generated, received, and routed based on defined conditions.

If desired, Elysium Exchange can be configured to route de-identified / pseudo-anonymized data to interfaced systems, such as public health population surveillance systems.

If necessary, the pseudo-anonymization can include identifiers that will enable appropriate users to link back to identified patient records.

The Elysium Exchange solution using the Elysium Immunization Gateway enables members of the HIE community to collaborate with local and state registries. Stakeholders can therefore both receive and send immunization data securely and in a timely manner for improved patient care in Arkansas.

The Elysium Exchange solution also offers a Registry and Reporting tool kit. The Registry tool kit, in combination with the Reporting tool kit, enables the creation and update of multiple registries, typically one per chronic disease or health maintenance objective. Each registry has a design (schema, views, forms, reports etc) that is specific to the chronic disease or health maintenance parameter. The HIE stakeholders can therefore track and report on the effectiveness of treating diabetic patients for example in the community.

For Payers (private and public)

As discussed above, the Elysium RxGateway allows the HIE community to implement ePrescribing. Beyond e-delivery of prescriptions and refill requests, there are many benefits to Elysium's RxGateway. Many Elysium HIE customers are supported financially by payers because it's understood that benefits and savings will accrue over time. These payers have worked with SureScripts-RxHub to allow provider access to patient eligibility, drug formularies, prescription fill history, and generic drug alternatives. In turn, the payer agenda is put at the physician's fingertips, and savings are experienced across the exchange. This eligibility information may be easily populated from manual or automatic queries to SureScripts-RxHub. These queries provide real time data on patient eligibility status, thereby simplifying billing processes tied to medication management.

In addition, Payer system can be integrated through custom or standardized interfaces or via web services through Elysium Open Access SOA Platform. See section 4 for more details on Open Access.

2. Technical Architecture and Approach

- The HIE will provide an infrastructure that is **secure** and protects the **privacy** of consumers, providers, and other constituents. Participants can be confident that their health care data is secure, private, and appropriately accessed.

Since the mid-90s, the national standard of patient privacy policy has been defined by HIPAA and the resulting "Privacy Rule". The Privacy Rule's standards address the use and disclosure of individual's protected health information (PHI) by various healthcare related organizations. Axolotl is no exception to these organizations, and realizes that securely delivering, exchanging, and storing PHI is essential to assure patients their due privacy.

Restricted Access to PHI

A main principle of the Privacy Rule is to prevent the availability of patient data to anyone other than healthcare providers designated by the patient. In addition to security measures to block intruders from accessing the network or system (please see Network Security below), privacy from unauthorized users is provided by the Elysium User Directory, nested within the Lotus Domino Directory. The directory provides user role and user workgroup creation, configuration, and administration tools. When users access the system, configured roles and workgroups are cross checked against database Access Control Lists (ACLs). ACLs define the users that can access a database, the data that can be accessed by those users, and the actions that they can perform on that data. Through these tools, Elysium Exchange restricts users, such that they may only access, edit, and manage clinical data according to their clinical workgroup and / or staff position.

Precise Patient Search

PHI is further protected by Elysium Exchange's precise patient search technology. Elysium Exchange's patient index can find and return patients based on many items of patient information. Furthermore, patient index search engine restrictions are highly configurable. By configuring strict search parameters that require multiple items of patient information for the return of results, health systems greatly reduce the chance of physicians accessing PHI for patients they aren't treating.

Comprehensive User Audit

Elysium provides robust auditing capability for all access obtained to personal health information (PHI). There will always be some cases where users may misappropriate clinical data, despite hardware security and configurations in the Elysium User Directory. In the case of such misappropriation, Elysium Exchange components provide the ability to audit users for the clinical information they have accessed, and when and from where they accessed it (please see Framework Components – EUA). In this way, an HIE may inform patients of all PHI that was compromised.

- The HIE will **improve the health care delivery** process in Arkansas by providing information availability when and where it is needed.

Using the Elysium solution, clinical information will be delivered to the users and stakeholders of the Arkansas Health Information Exchange when and where it is needed. The presentation components provide the user interface services for Elysium EMR Lite and Virtual Health Record users, enabling end users to receive, view, access, and manage data from a basic workstation with just a standard web browser and internet connection. Data is thus available securely anywhere, anytime. In addition, clinical data can be pushed to and accessed from the EMR application of choice of a provider without any disruption in the current practice's/hospital workflow. The Elysium Exchange can thus also leverage existing sources of health information and capitalize on current health exchanges within Arkansas.

- **Best practices and standards** for information technology infrastructure will be utilized to the extent possible and practical in the creation of the HIE.

The Elysium Exchange is built on established information technology infrastructure standards. The Elysium platform offers a rich, standards based set of web services for application integration. Integrated applications, either custom developed or provided by third party vendors, can interoperate seamlessly with Elysium applications and modules such as Elysium EMR, VHR, patient index and clinical summary. The web services offered by the Elysium SOA platform are highly secure and designed to support high transaction loads. The web services are built using Java EE. They use an enterprise service bus for event-driven communication. A variety of recognized,

secure network standards are also supported. HTTPs, SSL, TLS, sFTP, VPN tunnels, and Web Services (using SAML and WS-Security standards) are all examples of network connectivity standards utilized by Elysium Exchange. Other standards supported

- .NET
- Web Services
- JAVA
- C++

Elysium web service components have been designed to be flexible, and all user and system activity is authenticated and logged according to IHE / HITSP standards. Role based security configurations limit the service access available to each authenticated user or system.

The following interface standards are supported by the Elysium Exchange - HL7 v2.2+, HL7 v3, HL7 CDA. Wherever possible, Axolotl prefers to utilize standards such as HL7 within Elysium Exchange. However, any structured data format can theoretically be mapped and therefore exchanged with other HIE interfaces systems. Elysium Exchange currently supports a variety of terminology and vocabulary standards, including ICD-9, CPT-4, NDC, and LOINC.

- **NHIN standards** specifications will be implemented in establishment of the NHIN Gateway functionality.

Elysium Exchange's Inter-HIE Gateway has been developed to support health information exchange across HIE systems, and are being deployed to support multi-regional workflow requirements. Elysium Inter-HIE Gateway is designed based on the standards and principles of the Nationwide Health Information Network and of smaller initiatives such as the Statewide Health Information Network of New York, as defined by IHE, HITSP, HHS, ONC, and others. As such, Elysium Inter-HIE Gateway is capable of supporting a variety of exchanges of patient data across HIEs, regardless of the HIE system in question.

- The HIE technical infrastructure will attempt to **leverage existing sources of health information** to the extent possible and capitalize on current health exchanges within Arkansas.

Elysium Exchange is also designed to leverage existing systems in hospitals and community health organizations. This includes EHR systems in addition to a variety of acute and legacy systems (e.g. LIS, RIS, HIM, etc).

Generally speaking, Axolotl attempts to accommodate and improve on existing workflows through HIE integration with existing workflows and corresponding systems. For example, Axolotl generally tries to provide all functionality to end users in their application of choice. This means

enabling the user with access to data from his / her chosen user interface. This could mean providing access to HIE routed data through an existing EMR, through Elysium EMR, or through connections to print / fax machines for paper copies of reports. Based on this accommodation, no provider should have to adopt a new system or workflow unless he / she chooses to.

- The HIE architecture will support an **incremental deployment** of a statewide exchange capability.

The Elysium Exchange platform is built on a service-oriented architecture that can grow as the adoption of the Arkansas HIE grows from providers, to payers, to public health registries, and to the general public. It is the ideal platform for a phased approach. It can help satisfy all of the broad objectives of the project.

Axolotl uses its Framework-based Gateways through the Elysium SOA Platform to allow the Arkansas HIE to integrate more and more external systems and applications as the need arises and as more and more phases of the implementation comes into fruition.

- The HIE technical infrastructure will start with **proof of concept** and expand as rapidly as technologically and operationally feasible within the financial constraints of the project.

The Elysium Exchange solution has a flexible architecture that will allow the state to start small and then build up. The start can be small enough to be a proof-of-concept system where Axolotl will possibly deploy one or a few EdgeServers to process the feeds from, to start, one hospital. The Elysium Server and its repositories can thus be populated and used by a pilot group of physicians from this hospital to validate and test the Virtual Health Record view, to test and validate collaboration between different practices outside the hospital and the resident physicians using the EMR tool of their choice. Through this validation and testing process, the stakeholders can quickly see the benefits of the HIE framework. The Elysium Exchange architecture is flexible to do this.

- The HIE technical infrastructure will provide **messaging infrastructure** with guaranteed, secure information delivery.

The Elysium Exchange is provided through a SaaS approach, all hardware is hosted by Axolotl. Hence, for messaging within the Elysium Exchange, IBM Domino's secure messaging protocols heavily encrypt and transport clinical data within Domino's flexible document structures.

The Elysium Exchange supports security protocols so that stakeholders and end users can send clinical data to and out of the HIE. Hence, for traditional message delivery, transport of HL7 and other clinical message types is typically conducted over the Minimal Lower Level Protocol (MLLP). MLLP allows source and destination systems to establish data feeds for ongoing transport of

clinical data. MLLP feeds are established (over secure network connections) to link external systems to Elysium Exchange for guaranteed delivery.

3. Design Principles and Requirements

Vendor Neutrality

Native applications can be integrated into the Arkansas Elysium Exchange HIE because the solution supports the web services and J2EE platforms. As a web based product, many features of Elysium are provided through J2EE Web servers. Through these servers, Elysium Exchange offers a variety of web services for comprehensive data exchange capability across systems. Most importantly, web services allow for real time query and transfer of data through standardized technologies and protocols. Elysium Exchange Web services are built on a variety of widely used open standards such as java, XML, and Web service standards. Elysium Exchange's J2EE server technology is generic, and may run on any Web Application server capable of supported J2EE (e.g. Glassfish, WebSphere).

All Elysium Exchange end user products are web based, and therefore rely on standard web markup languages and protocols for the user interface. As with most web pages, Elysium user interfaces are largely built using HTML code. DHTML and Dojo are also heavily employed to allow for dynamic user interaction with the application through the web interface.

Elysium Exchange user interfaces were designed to run most efficiently on Microsoft's Internet Explorer web browser, but work well on most common web browsers. Microsoft Internet Explorer is the most widely used Web browser on the market and has set the standard in web browsing since its release in 1995. Elysium end users may securely access the various U/Is through Microsoft's IE7, utilizing its built in SSL support and other optional security features. Elysium runs well on most commonly used browsers. However, in order to provide the best support possible to end users, Axolotl only officially supports end user systems running Windows (Windows 2000 and newer) and Internet Explorer (or compatible W3C browsers).

Elysium Exchange is also designed to leverage existing systems in hospitals and community health organizations. This includes EHR systems in addition to a variety of acute and legacy systems (e.g. LIS, RIS, HIM, etc).

Generally speaking, Axolotl attempts to accommodate and improve on existing workflows through HIE integration with existing workflows and corresponding systems. For example, Axolotl generally tries to provide all functionality to end users in their application of choice. This means enabling the user with access to data from his / her chosen user interface. This could mean providing access to HIE routed data through an existing EMR, through Elysium EMR, or through

connections to print / fax machines for paper copies of reports. Based on this accommodation, no provider should have to adopt a new system or workflow unless he / she chooses to.

A sophisticated EMR user, for example, may receive results, referrals, and other data from the HIE, may query for and retrieve information from the HIE, and may export and submit data to the HIE. So far as promotion of HIE utilization, when such functionality is offered, the solution essentially promotes itself. Through results delivery directly to the EMR (without costly point-to-point interfaces), the ability to query and retrieve directly from the EMR, and the ability to route and share information with other community providers, users will be enabled with a vastly improved workflows that increase office efficiency and improve the quality of patient care. If these efficiency and quality improvements aren't enough, this same HIE based functionality will also enable providers to qualify for upcoming meaningful use incentives and requirements.

Elysium Exchange supports a very wide range of interfaces to proprietary and standards based systems out of the box, so frequently all that is required for interface activation is an established network connection and the configuration of an existing feed map. For systems that have not been previously interfaced with Elysium, Axolotl's implementation staff has built a wealth of experience mapping to proprietary and standards based data structures, and can configure Elysium Exchange gateways to map to / from any structured data format.

Whenever possible, Axolotl strongly prefers and recommends the use of established standards (such as HL7 v2, v3, CCD, IHE Profiles) to build the interfaces with all the stakeholders' products. However, Axolotl's implementation team works with data sources and end users to adjust data source output and feed map configurations as required, until the data output appears accurately and as desired to end users. Typically, if non-standard data structures are used, the messages will be translated and mapped as appropriate to the relevant standards for storage and access within the HIE system.

A partial list of ready to deploy, existing interfaces with Elysium Exchange is available below.

Inbound [to Axolotl Applications]	Vendors
Patient Registration [ADT]	*Avairis* *Cerner* *EPIC* *HBOC* *HMS* *IDX* *Invision* *McKesson* *Meditech* *Paragon*

	Quadramed *Siemens* *Touchworks*
Laboratory Information and Results Reporting	*Afflab* *Antrim* *Cerner Radnet* *CompuLab* *DRL Labs* *Hunter* *LabCorp* *LabDac* *McKesson* *MDS* *Meditech* *Misys* *Orchard* *Quadramed* *Quest Diagnostics* *SCC Softlab* *Siemens* *Stanford Labs*
Radiology Information and Results Reporting	*ADAC* *ATMS* *Cerner* *Chartscript* *Custom Word and WordPerfect radiology transcription services* *IDX* *Keane* *McKesson* *Meditech* *Misys* *Novius* *Paragon* *Powerscribe* *Quadramed* *Siemens*

Health Information Management (HIM) ***(includes dictation and transcription)***	*Arrendale* *ATMS* *Dictaphone* *Dolby* *DVI* *Lanier* *Medquist* *Quadramed* *Softmed* *TNI* *Your Office Genie*
Pathology	*Cerner* *Cortex* *Dictaphone* *Misys CoPath* *SoftPath*
Benefit Administration	*EZ-Cap*
Patient and Operative Scheduling	*Athena Health* *EPIC* *IDX*
Interface Engines	*CAI* *Cloverleaf*
Electronic Document Management	*Cerner* *Certify Data Systems* *Kofax* *Lanier*
Outbound [From Axolotl Applications]	
Electronic Document Management	*Certify Data Systems* *Elysium* *Lanier* *McKesson*
Benefit Administration	*EZ-Cap*

Data Repositories	*Elysium* *EPIC* *FirstChart*
EMR's	*A4 Health Systems Healthmatics* *Allscripts* *eClinicalWorks* *Elysium* *Epic EpicCare* *GE Centricity* *Greenway PrimeSuite* *Interface Healthcare (NextGen ASP)* *McKesson Practice Partner EMR* *Misys EMR* *NextGen EMR* *Sage Integrity* *Several small specialty EMRs*
Health Information Management (HIM	*ATMS* *ERM* *Keane* *Softmed*
Order Entry	*Atlas* *Epic* *Quest Diagnostics*

Flexible Architecture Support for a Hybrid-Federated Model

The Elysium Exchange solution allows the Arkansas HIE to start with a centralized architecture, and in a phased implementation, evolve into a hybrid architecture.

Data in Elysium Exchange can be stored in a central clinical repository, accessed in real time from the source systems (federated) or, as has been proven successful over many deployments, can be stored outside of the source system but independently of data from other sources (based on a configurable number of factors such as data type, source providers and so forth). The latter model is what Axolotl refers to as the hybrid federated model.

While all types of architectures are supported, Elysium Exchange has been most successful with the hybrid-federated data model, where data is extracted from original source systems and maintained in federated Elysium repositories. This avoids commingling data, as may be seen in a centralized model, and also alleviates data retrieval availability and performance issues due to accessing a variety of data source systems, as may be seen in a fully federated model.
Regardless of the architecture model, Elysium Exchange provides the flexible technology, functionality, and toolsets required to appropriately deploy, configure, support, maintain, and expand the Arkansas HIE to any medical trading area.

Facilitating Information Exchange via a Network

One of the reasons Axolotl has had a lot of success implementing HIE solutions is that we minimize any disruption to the existing workflow of a practice or a stakeholder. An Arkansas provider continues to use the EMR of his choice for example. He just has more information available at his fingertips to collaborate with, and thereby improve the care of his patients. He does not have to learn new applications and there is no steep learning curve to hurdle. Using the tools of his choice, he can immediately make use of the functionalities of the Elysium Exchange. This is because the Elysium Exchange is designed fundamentally as a clinical messaging system.

Axolotl has long practiced the ideology that whenever possible, data should be "pushed" or delivered to end users. This practice alleviates the requirement of end users to query for data every time it is needed, as data is delivered directly to the end users application or format of choice. Users may still have to initiate a query for data retrieval, however they are at least made aware of the presence of data, instead of having to arbitrarily initiate data queries.

Results delivery and push functionality is provided through the Elysium EdgeServers. These EdgeServers may push results either to existing EMR systems through Elysium Interoperability Hub, or to the Web based Elysium EMR and Elysium Virtual Health Record applications. The Elysium EMR provides a way for Arkansas providers who do not have an EMR system, to make use of one. The Elysium EMR is also a nice complement to a provider's existing EMR system, providing added functionality and ease of use. The Elysium Virtual Health Record (VHR) allows members of the Arkansas HIE to view information on a patient in a longitudinal way. Arkansas clinicians can use the Elysium RxGateway to send and receive medication information through the HIE. Specific results or demographic data may also be routed to payers and other partners through Elysium EdgeServer, as desired.

Bi-directional data exchange can be achieved with various EMR systems through Elysium I Hub, or through the Elysium Open Access SOA platform. Physicians will be able to exchange secure communications, which may or may not include attached clinical results or data (e.g. test results, CCD summary document). Order templates are easily configurable in Elysium EMR to enable

electronic ordering through a Web based "portal." These orders can be routed seamlessly to the supplier, electronically.

The Arkansas community wide records for patients will continue to be exchanged extensively through the push of results to providers. Over time, a community wide health record is built for patients, a record that may be queried for and retrieved by authorized providers. This query and retrieval may be performed either by users of Elysium Virtual Health Record, or by users of third party EMR / EHR systems enabled with IHE Web service profile capabilities. Users may optionally decide to create a local copy of retrieved data within their chosen EMR system. All the data that is viewed and retrieved from entity specific repositories as a part of this process is standardized during the results delivery process (a function of Elysium EdgeServer).

As data grows the Elysium Reporting Hub will provide the reporting functionality required to perform extensive population and population subset analysis with the goal of developing disease registries for care management. Based on the report content and registries generated, providers can apply clinical decision support rules and can interpret results to determine the appropriate course of action for patient or population treatment and alerting.

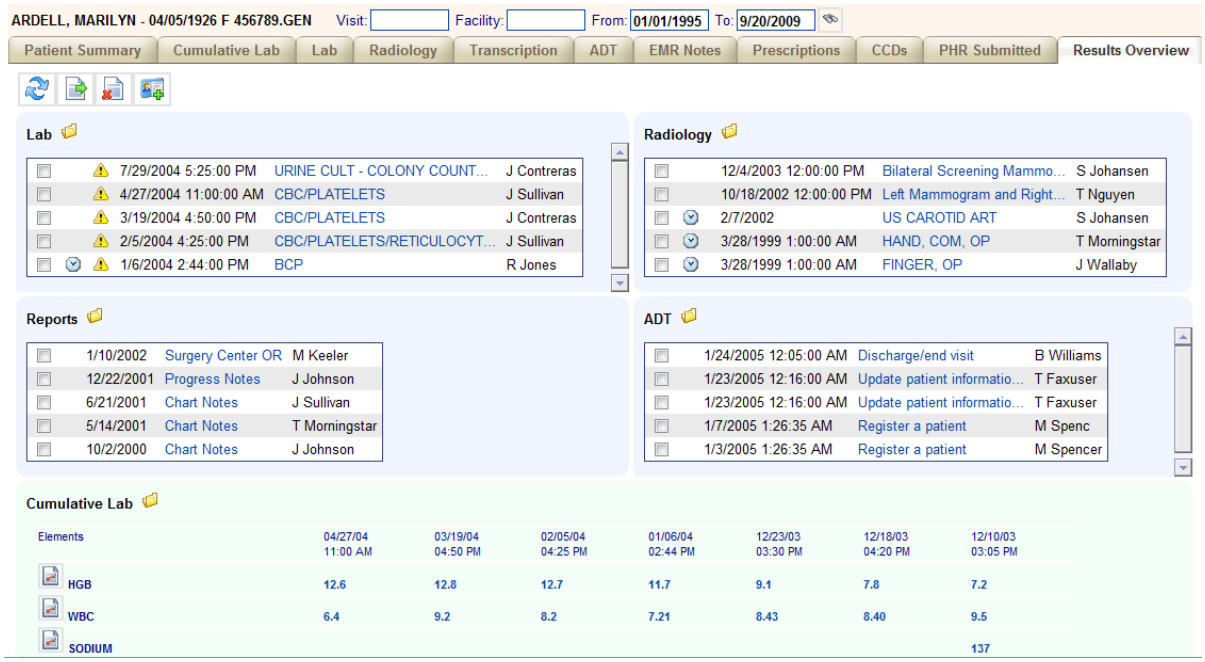
Over time the Arkansas Elysium Exchange HIE may be leveraged to route relevant clinical details to payer and insurance systems. It should be noted that Elysium Exchange is not specifically designed to file claims and perform billing functions, however the system is designed to integrate the Practice Management and other administrative systems that perform these functions. That being said, payer eligibility verification query is an easily implemented function of Elysium Exchange – standard 270 / 271 query and response messages are supported for patient eligibility query and retrieval. If no payer is interfaced, this query / response workflow is routed to and from Surescripts for eligibility details.

Support for a Longitudinal Patient Record View

The Elysium Virtual Health Record retrieves and displays all data available for a patient from a variety of source systems through Web enabled queries and a customizable reporting tool kit. Data retrieval and display occurs via record locator services, gateways to internal and external entities (i.e. Surescripts, external HIEs), and Web services.

A patient's Virtual Health Record (VHR) is pulled together, virtually, to create an electronic health record that contains all available patient data across the continuum of care. Elysium gathers data from a variety of sources to bring together a patient's VHR, including Web service queries to external applications, EdgeServer and I-Hub data repositories, Encounter Data Store, patient index (or indices), and any other query able data source.. A patient's VHR can include admission records, discharge summaries, visit records, medication history, problem lists, allergies, up to date eligibility information, the results of all tests and exams ordered by clinicians, and any encounter

notes, referrals and orders that exchange participants are willing to share. This information is displayed similar to a patient chart, with different result types filed under different virtual tabs. In some environments, Virtual Health Record users may select data from a patient's VHR and forward selected results to their chosen EMR or EMR Lite system (this feature is dependent on source system and exchange policies and configurations).



Beyond individual patient care, Virtual Health Record administration accounts can be created to view and manage results across an exchange. These users will have access to tabs that may contain all reports that meet selection criteria across an entire community. This capability grants administrative staff the ability to easily audit and manage reports community wide. Useful examples of this feature include administrators resolving unidentified reports in repositories or viewing all recent admits or discharges for a hospital or community.

It should be noted that both user and administrator Virtual Health Record tabs are customizable. Tabs can display data based on selection criteria that may defined by complex formulas. The use of formulas allows extensive ability for tab customization to suit community, practice, and even individual user requirements.

Interoperability with Other Community and Private HIEs

As HIE's expand and develop traction throughout the country, the need to exchange data between systems and across regions has become a mandate. To address this need, Axolotl continues to develop its Framework based Gateways through the Elysium SOA Platform. Through these

gateways, Axolotl's notion of multi-system cross community architecture follows the same principles and standards adopted for NHIN prototype architecture. This technology is currently being deployed for production at existing regional Elysium Exchange deployments. As Elysium SOA Platform based gateways are deployed, an enhanced Elysium Exchange is realized with the ability to share data seamlessly across systems, communities, and the nation.

With the increased need to link private and public HIEs plus the development of NHIN, national or state patient indexes and repositories will likely be built. Repositories would be filled with millions of records, and would require high storage availability. Also, the development of recent standards has shown a trend of storing patient summary data in XML format (CCR, CDA, CCD). This in mind, built in XML support will be critical for efficient record indexing and RLS retrieval functionality (e.g. XDS.b utilization of ebXML). To address these trends, the Elysium Exchange utilizes IBM's DB2 database technology. Although relational databases may be inefficient for containing diverse sets of data, they are extremely efficient for containing standardized sets of data. In Elysium Exchange, this efficiency is realized in the patient index and clinical repository databases. Major advantages of Elysium's DB2 utilization include virtually infinite storage and DB2's built in XML support. Looking toward the future, the value of these advantages becomes clear.

Axolotl recommends the utilization of high speed direct attached storage for high performance and storage scalability, and of careful utilization and configuration of NAS, SANs, and VM deployments. Axolotl's Technical Operations team carefully installs and configures all server environments, based on general IT and Elysium Exchange specific best practices. Use and appropriate configuration of this storage provides additional data redundancy, and allows the system to offload backups and heavy disk I/O to external hardware.

Elysium Exchange's Inter-HIE Gateway has been developed to support health information exchange across HIE systems, and are being deployed to support multi-regional workflow requirements. Elysium Inter-HIE Gateway is designed based on the standards and principles of the Nationwide Health Information Network and of smaller initiatives such as the Statewide Health Information Network of New York, as defined by IHE, HITSP, HHS, ONC, and others. As such, Elysium Inter-HIE Gateway is capable of supporting a variety of exchanges of patient data across HIEs, regardless of the HIE system in question.

Also, to support the wide variety of requirements for inter-HIE communication, Elysium Inter-HIE Gateway is capable of supporting more transactions that those recognized by NHIN. As such, Inter-HIE Gateway customers may be able to send and push data across regions (such as referrals and patient summary information), rather than just being limited to a query model to retrieve available patient information. Axolotl's experience with NHIN demos, SHIN-NY deployment, and other statewide initiatives in the US has been integrated into Elysium Inter-HIE Gateway, allowing the component to accommodate a range of cross regional workflows and requirements.

Adherence to Standards

In order for truly efficient information exchange to occur across a range of systems and applications, information standards must be utilized. Since inception, Axolotl has closely followed and adhered to the standards of the greater healthcare community. These standards are referenced from a variety of sources, including IHE, CCHIT, HL7, HITSP, HHS, and ONC.

Standards for data format

By far, the most widely used formats for clinical data in the HIT world are standards established by Health Level 7 (HL7). HL7 is a not-for-profit organization that focuses on developing international healthcare standards. HL7 has pioneered multiple clinical data formats, the majority of which are compatible with Elysium Exchange, including HL7 v2.x, HL7 v3, CDA, and CCD. Specific vocabulary and terminology standards are utilized within these formats, and are specified below.

Standards for data transport and messaging

Before detailing the standards employed for transportation and delivery of clinical data, it is key to note that there are at least two general forms of data transport in an HIE system. The first, traditional method of transportation consists of sending a message file (e.g. HL7) to a recipient destination. More recently, clinical data exchanges have taken advantage of Elysium Exchange web services that allow for real time query and entry of data into web based applications.
For traditional message delivery, transport of HL7 and other clinical message types is typically conducted over the Minimal Lower Level Protocol (MLLP). MLLP allows source and destination systems to establish data feeds for ongoing transport of clinical data. MLLP feeds are established (over secure network connections) to link external systems to Elysium Exchange. For messaging within the system, IBM Domino's secure messaging protocols heavily encrypt and transport clinical data within Domino's flexible document structures.

For web service data transport, Elysium Exchange offers a variety of web service standards established by IHE, OASIS, and other standard setting organizations. These organization were started by healthcare professionals to improve the sharing of clinical information across computer systems. These develop web service standards, assemble clinical use case requirements, determine the standards to satisfy the requirements, and produce technical instructions to implement the standards. Axolotl has followed these instructions for a variety of standards, including PIX and PDQ for patient demographic query, and XDS and XCA for the exchange of data within and across communities. Other services that Elysium provides include SOAP, WS-addressing, and services to retrieve DICOM radiology images, Quest lab results, and transcription reports from external systems.

Standards for Authentication and Security

Elysium provides industry recognized standards for authentication and security. Because the application is web based, authentication must be established through the browser interface. Elysium utilizes the available authentication tools from the Domino platform, web browsers, and more, including session based authentication and SSL encryption. For web service authentication and security, WS-security policies are employed such as SAML, the X.509 token profile, XML encryption, and XML digital signature.

Standards for vocabulary and terminology

Complete interoperability requires the use of standard terminologies across systems. This is perhaps the most difficult challenge posed to health organizations. Elysium currently makes use of many standard vocabularies including LOINC, NCPDP, CPT4 and ICD9 as well as some Elysium specific vocabularies.

For advanced semantic interoperability, Axolotl is currently in the final stages of evaluation to select a terminology services provider for integration. Axolotl expects to have the chosen solution integrated within 2010. The integrated solution will enhance Elysium Exchanges vocabulary support to include SNOMET-CT, RxNorm, ICD-10, and a wide range of other terminologies.

Redundancy, Scalability, Recoverability

Elysium Exchange is designed to be easily scalable with minimal impact to workflow and communication. Once the basic exchange system has been established, additional data sources and external systems can easily be added without disruption to user access or performance. Because Elysium EdgeServers (Elysium Exchange's clinical results translation and delivery engine) are set up as distributed gateways rather than a part of the central framework, they can be put into production without disrupting the functionality of the framework, other distributed gateways, or the user interface. Similarly, establishing connections to various EMR / EHR systems will have minimal impact on the framework or user interface. Framework Elysium Interoperability Hub (Elysium Interoperability Hub, or I Hub, facilitates the translation and delivery of data between EMR/EHR systems) feeds may be deployed without any noticeable change to performance or availability. For Web service utilization, new Web services may be exposed over time without affecting existing services. Service updates are applied similarly to other system updates; during non-peak hours such as nights and weekend so as to minimally disrupt system performance or service access.

Beyond this non-disruptive expansion methodology, scalability is provided through hardware assignment and configuration, and through platforms that support heavy data and service access / utilization.

Configurable Display Templates

The expandability and scalability feature of the Elysium Exchange solution is promoted by the use of display templates. Display templates and other forms provided to Elysium Exchange user interfaces are easily customized and configured by HIE administrators. These forms may be configured to contain a variety of fields and field types, and may also be configured to map to standard data structures should the documents / records be exported or routed beyond an Elysium Exchange user interface. As for display templates and forms for other systems, the ability to consume and view a template or form is largely dependent on the system that has to consume the data. However, from an infrastructure standpoint, Elysium Exchange repositories may contain a vast range of data types and structures (such as customized community or hospital templates).

Performance

Axolotl contractually guarantees system uptime in Service Level Agreements (SLAs). Clients can generally expect at least 99.9% availability and uptime, with the exception of scheduled downtime for maintenance purposes.

Redundancy

Redundancy is provided at a number of levels, including redundancy for storage, client servers, and network infrastructure components that support the hosted solutions. Storage devices, for example, are configured for high performance and redundancy through RAID arrays. Clustered servers may be deployed for system redundancy and failover, either within one data center or across both of Axolotl's data centers (for additional, geographic redundancy). Finally, network infrastructure components, such as firewalls and switches, are deployed in pairs in each data center for high availability and redundancy failover capabilities.

Should these redundancy measures fail, Axolotl also provides regular backups of all client systems. Axolotl recently transitioned to a robust disk-to-disk backup system, where full backups and restores may be performed for very large systems in a matter of hours. Should only a partial system restore be required, the backup system supports storage and rapid restore of data at the database, document, and block levels. Backed up data is also replicated and stored in both data centers, so system restores may be performed at either data center location, should one data center become unavailable.

Security and Auditing

All Elysium Exchange platform components, including the user interface applications, are highly secure and highly configurable to meet a wide variety of privacy and security regulations (i.e. HIPAA, ONC meaningful use requirements, state law, entity policy). Security and privacy

measures are taken at multiple levels (physical, network, platform, application levels) to ensure appropriate protection of any sensitive data.

System Policies

Elysium Exchange security policies are highly flexible, to support a variety of regulations and requirements, even within a single HIE deployment. The degree to which configured policies affect a given end user is very closely related to the level of integration of that end users system with the Elysium Exchange platform. For example, an EMR user who is simply receiving results from the exchange network will not be greatly affected by most system policies. However, a provider who interacts closely with the network through tightly coupled Web service integration may be subject to higher degrees of policy restriction / regulation (e.g. policies for minimum data set for patient record retrieval, policies for patient consent).
Elysium Exchange system policies are highly configurable, and may be easily deployed to apply different policy configurations to different sets of users within the greater exchange population. This flexibility is critical for Elysium Exchange networks that either consist of multiple (potentially competing) stakeholders, or for networks that span across state or regional boundaries. Through these policies, Elysium Exchange is easily deployed to meet a wide variety of provider workflows and business needs.

Security may remain “federated” in an Elysium Exchange deployment based on how systems are integrated. The Elysium Exchange platform is configurable to apply security policies to sets of users as desired, and may optionally respect the security policies of integrated external systems. Generally speaking, some level of security restriction is applied to any integrated or interfaced system.

Exchange Connections and Protocols

Secure network connections and protocols are responsible for the transfer of PHI into and outside of the network. Web standards such as VPN tunnels, WANs, SOAP, HTTPs, and sFTP greatly reduce the threat of third party interception of sensitive data. For data transfer to Elysium U/I end users, SSL encryption is utilized to encrypt any data going to Web browsers for display. For web services, secure network transport is provided by WS-security components such as SAML, the X.509 token profile, XML encryption, and XML digital signature.

Logging and Auditing

Auditing services may be provided at a number of levels. Elysium Exchange is IHE ATNA profile compliant; all authentication, interface use, and data import / export is logged to Elysium internal logs or to Web service audit repositories. All audit data is easily exported for analysis and reporting. Audit logging is configurable, all events are auditable (login/logout, lockouts, records viewed, data accessed, web services use, etc.) and reporting tools are configurable to easily track

event trails. Some of these audit services may be provided by tools internal to Elysium Exchange, such as the Elysium Usage Analyzer, described in detail below. For Web service audit, Elysium Exchange provides services to populate and query ARRs. Elysium may also provide ARRs for population and query from any authorized users.

Additionally, Elysium Usage Analyzer (EUA) provides usage, performance, access, and security reporting for activity within an exchange. Elysium Usage Analyzer exists as a Domino database. This database references server log files of all web activity on the server. The EUA pulls data for a configurable time range, sorts it, and displays it in a number of views for reporting and analysis. Because the EUA produces a comprehensive view of web server activity, it proves itself ideal for system performance analysis. The EUA retrieves all data related to user web requests. As such, administrators may easily break down user activities, the time it takes the system to receive web requests, and the time it takes the system to respond. This kind of data allows for detailed analysis of overall system performance, specific component performance, specific user performance, most common user activities, and more.

Beyond system performance, the EUA provides views and tools for user audit and investigation into misuse of PHI. Administrators with appropriately configured security roles may access restricted views, configure and run security audits, and view audit reports to determine what information was accessed by which user. This information can then be relayed for HIE staff to address appropriately.

The audit tools provide the ability for users to both proactively and reactively report against audit information. If desired, audit reports may be run for up to the minute access of the system or specific data. As such, audit report data may be used to identify users who have consumed PHI. There is some flexibility with regard to logging options for the Arkansas Elysium Exchange HIE. Various system components support a variety of log levels, and system audit tools (e.g. Elysium Usage Analyzer) may be configured to only reference and pull specific log information. Custom audit rules may easily be generated, as the reporting module for generating EUA audit reports is highly flexible. The EUA does not currently include automated alerting for audit exceptions, however the product may be enhanced to provide automated alerts to security administrators if required.

Arkansas Act 1227 of 1999: Accesibility Requirements

Inasmuch as the Elysium Exchange solution supports the use of universally-known internet browsers like IE, any features these browsers have that support voice-recognition technologies can be made available to the public.

The Elysium solution also runs on the Windows O/S. Hence any technologies that this O/S has to support voice-recognition such as Windows 7 Speech Recognition feature can be made available.

4. Architecture Overview

Axolotl's Elysium Exchange consists of a collection of highly configurable commercial products. Only proven applications, rather than prototypes, are deployed for production HIEs. More than a dozen state and regional HIEs use Elysium technology and Axolotl servers maintain connections with hundreds of data sources across the country. As Elysium Exchange has evolved since '95, configurability has been substantially enhanced to meet the varying needs of new and seasoned customers.

Elysium Exchange may be split into three divisions of architecture: framework or central components, distributed gateway components, and end user interface or presentation components.

These components and their layered architecture support a distributed or hybrid approach for data vaulting and regional frameworks. This approach makes it easy to expand to additional participants and increase data availability with minimal impact to source systems. As start-up exchanges and RHIOs expand to include new entities and prepare to connect to state and national data sharing initiatives, additional Elysium instances are easily added and linked with gateways. This growth can take place at any time and requires no major design cycle; the Elysium architecture allows for changes to hardware configurations and software without disabling system functionality or interrupting services.

Elysium Exchange 9.1 is hosted by Axolotl at its two geographically separated data centers (one in Silicon Valley, CA and one in Baltimore, MD). This Software-as-a-Service model offers Axolotl's customers many benefits, including no infrastructure setup and maintenance, minimal hardware and software requirements for providers and end-users, and minimal staffing needs.

The Elysium Exchange system consists of Framework, Gateways, and Presentation Interface components:

- The **Framework** components provide the central core and services of system; Elysium Patient Index, Provider Directory, Usage Analyzer, and the majority of security, authentication, and auditing modules are located centrally.

- The **Gateways** provide the ability for users to communicate and access data across systems, both within and outside the community; bi-directional gateways from hospitals to providers (EdgeServers), from providers to each other (I Hub), from providers to patients (PHR Gateway), and from end users to outside systems such as payer systems, Surescripts-RxHub, and external HIEs, may all be deployed.

- Finally, the **Presentation** components provide the user interface services for Elysium EMR Lite and Virtual Health Record users, enabling end users to receive, view, access, and manage data from a basic workstation with standard web browser and internet connection. Please note that end-users do not have to utilize the Elysium EMR; they can use third-party EMRs.

On the next page is Elysium Exchange's typical deployment architecture, with care delivery organizations at the top providing data to the HIE, the various data consumers at the bottom, and the core hosted infrastructure components as well as value-added services in the middle of the diagram.

Elysium uses both a push model, where data is delivered to the providers in their tool of choice (e.g. Elysium EMR, third-party EMR, fax), much like in the paper world, as well as a pull model for cases where a provider wants to query the patient's community record for specific clinical information needs.

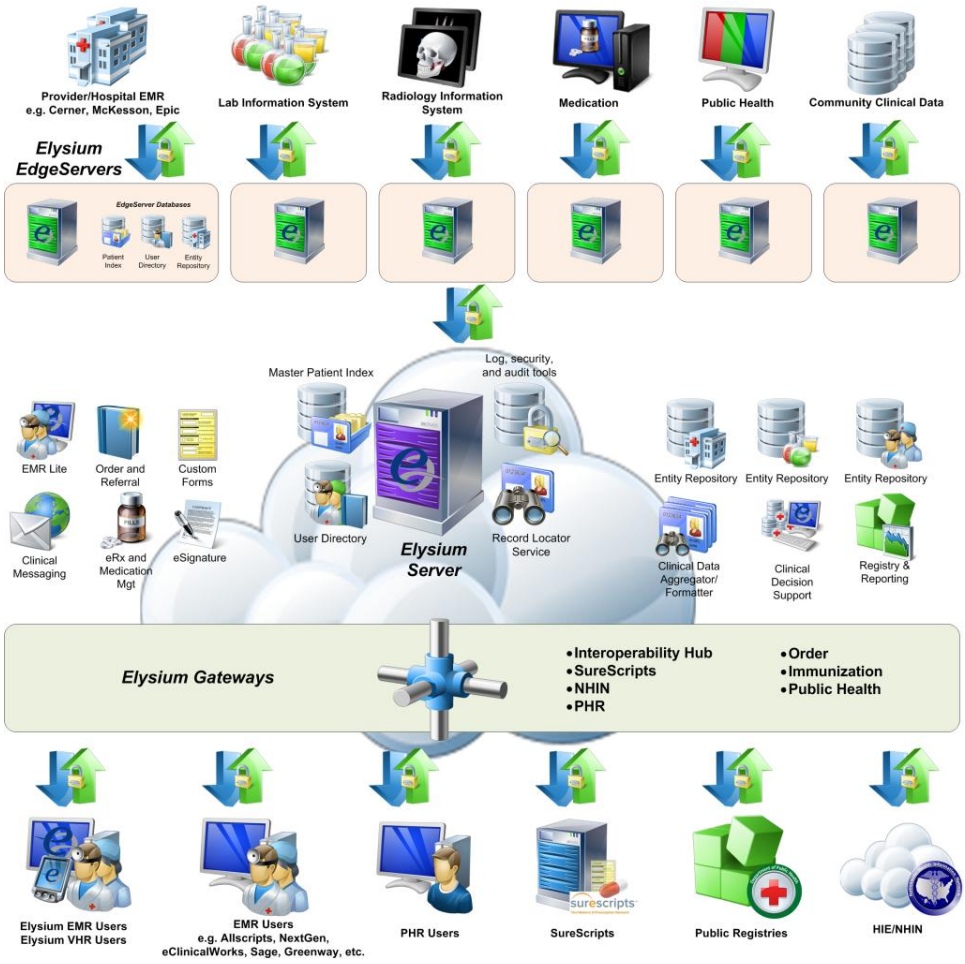


Figure 1 - The Elysium Exchange

Data in Elysium Exchange can be stored either in a central clinical repository, accessed in real time from the source systems (federated) or, as has proven to be very successful over the years, stored centrally but independently from each other (based on a configurable number of factors such as data type, source providers and so forth). The latter model is what Axolotl refers to as the hybrid federated model.

While all types of architectures are supported, Elysium Exchange has been most successful with the hybrid-federated data model, where data is extracted from original source systems and maintained in federated Elysium repositories. This avoids commingling data, as may be seen in a centralized model, and also alleviates data retrieval availability and performance issues due to accessing a variety of data source systems, as may be seen in a fully federated model.

At the heart of the Elysium Exchange system is the Elysium Open Access – Axolotl's SOA platform. This platform has been designed for heterogeneous application integration, and is built

using industry leading middleware technologies. The platform offers a rich, standards-based set of web services for application integration. The integrated applications, either custom developed or provided by third-party vendors, can interoperate seamlessly with Elysium applications such as the EMR, VHR, patient index and clinical summary. The web services offered by Open Access are highly secure and designed to support high transaction loads. The web services are built using Java EE. They use an enterprise service bus for event-driven communication, and use SAML and WS-Security for authentication and authorization.

The web services offered by Elysium Open Access are divided into several functional areas:

- **Infrastructure services** provide the foundation layer for higher level, application-oriented web services. These include core security, auditing and related web services.
- **Patient search services** are based on the IHE PIX/PDQ profiles, which are used to cross-reference and locate patients, as well as query demographic data about them.
- **Record locator and document storage/management services** are based on the IHE XDS.b (registry/repository) profile, and provide the ability to locate available documents for a patient in federated data repositories. Once the documents are located, they can be queried as long as consent/access requirements are met.
- **Semantic interoperability services** ensure that each community is able to capture coded data in its preferred vocabulary, but at the same time not losing essential interoperability during data transfer. Axolotl has embedded the Apelon DTS terminology server as part of Elysium to provide this functionality, which is also exposed as web services.
- **Clinical summary services** allow access to the clinical summary information about a specific patient. It contains information such as medications, allergies, problems, procedures and other data as specified in the HITSP C32 CCD construct, which is also the standard used to exchange the summary data with other systems. Clinical Decision Support, provided in Elysium in the form of drug interactions, duplicate therapy and health reminders, is among the advanced functionality that leverages the clinical summary information.
- **Gateway services** permit connections to various healthcare IT systems, registries, communities or other data aggregation services. These include Inter-HIE gateway services for connecting with other communities, regions or States using NHIN standards, PHR gateway services for communicating with PHRs, immunization gateway services to communicate with immunization registries, and so forth.
- **Reporting** services enables Elysium customers to build registries of patient populations and patient data for surveillance of infectious diseases or toxic substance exposure, to monitor health trends in the population, to manage patient care in patients with chronic diseases, and for health maintenance measures - just to name a few. It comes with pre-packaged templates to satisfy not only well-defined reporting requirements (such as those specified by the ARRA or PQI), but ad-hoc queries can also be made for customized reporting needs. Elysium Reporting Hub uses the data mart model (star-dimensional model) for reporting

and analytics, while allowing for 3NF and snowflake data models if so required. Finally, data can also be exported out of the Reporting Hub for use by any industry standard reporting tools (e.g. Oracle, Business Objects, Crystal Reports etc.).

Applications integrated with Open Access today include a PACS Image Exchange from partner eHealth Global Technologies. This integration enables authorized end users connected to our HIE to view and manipulate DICOM images and studies on heterogeneous PACS systems throughout the medical trading area with a unified viewer. We have similar web service integration with partner Greenway Medical for third-party EMR connectivity and PeerPlace for elder care services integration. Axolotl's vision is to enable any application that enhances the users' ability to provide better care to be integrated on our platform via our published and exposed APIs.

As evidenced above, Elysium keeps pace with the development of new interoperability standards. The current set of web services are built using widely accepted IHE, HL7 v3, HITSP and NHIN standards/specifications. The platform will continue expanding to include additional web services as standards emerge with a focus towards enabling integration with applications that deliver additional value to all organizations involved in delivering optimal patient care.

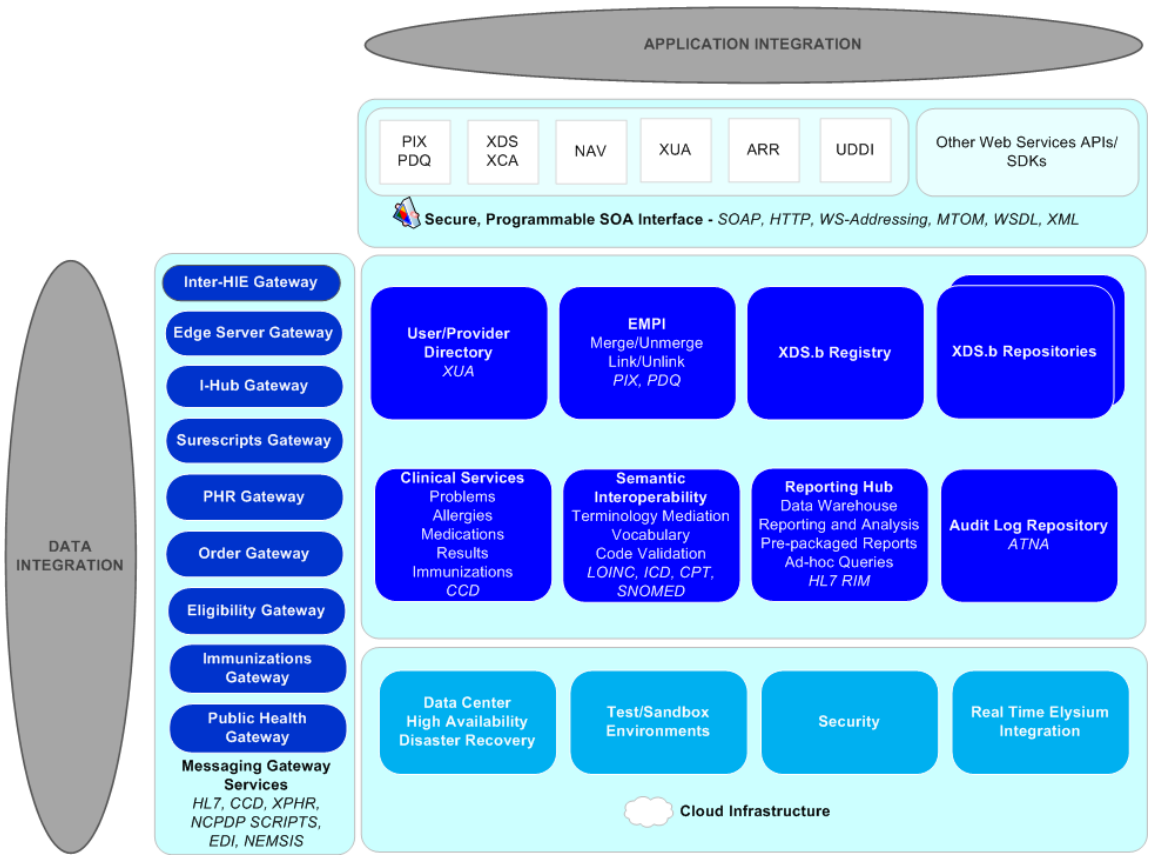


Figure 2 - The Elysium Open Access SOA Platform

Framework Components

Elysium Directory

Elysium Directory manages an exchange's user and workgroup registration, access rights, and security. Elysium Directories are nested within IBM Domino directories. IBM clients provide an interface for the administration of user accounts and access rights. Domino directories are LDAP compliant, so some Elysium Directory management is available via LDAP.

Elysium directory provides an exchange with all the necessary tools to add and manage system users. System administrators can easily add users with a host of configuration options at their finger tips. These options determine what may be accessed, viewed, and modified by users, in addition to establishing some basic user preferences and demographic details.

The various configuration options allow a great level of detail for user access roles and privileges. Beyond demographics, configuration options include system user type, available system add ons (e.g. eRx, lab ordering), user's workgroup, job category, prescription DEA and license numbers, user specialties, provider ID configurations, and more. With this diverse set of fields to define each user, administrators can grant a wide variety of access levels to the system according to each user's clinical role.

Within each configuration, users are assigned to a specific workgroup. For a typical end user, this workgroup consists of all users in a particular practice. As such, each user shares a practice specific database, allowing providers and staff to manage patient workflow easily and efficiently. It is important to note that practice workgroup information is cross referenced before patient summary data is displayed. In other words, patient summary data that is displayed may be practice specific unless consent has been otherwise set by the patient. This system prevents out-of-practice users from viewing clinical data to which they have no right.

Elysium I-Hub

Elysium I-Hub (Interoperability Hub) provides true interoperability through bi-directional exchange of HL7 and other clinical message types for users of disparate EHRs; referrals, labs, radiology reports, transcriptions, orders, and CCDs can all be exchanged.

Interoperability is defined as the ability of two or more systems or components to exchange information and to use the information that has been exchanged. There are a wide variety of architectures that will support the exchange of clinical information. The exchange can be a one-way "push" of information to authorized recipients, a "pull" or query of information from data repositories, or a bidirectional exchange of messages from one health care provider to another.

Elysium I-Hub exists as a combination of databases and agents that provide both "push" and "pull" services to users of disparate systems. These databases are capable of receiving, translating, appending to, and exchanging a vast number of information standards, including HL7 v2.2+, HL7 v3, CDA, CCR, and CCD, potentially utilizing IHE profiles such as PIX, PDQ, and XDS.b. For "pull" services, I-Hub provides repository services for all data exchanged from an EMR practice. If a patient and practice elect to share data with the exchange, data that is processed can be saved to I-Hub repositories for future query (for more details, please see Elysium Repositories under Gateway Components). This repository data is made available to EMR users through IHE based Web services (PIX, PDQ, XDS.b), or to users of Elysium VHR through a record locator service. Through this seamless "push and pull" of data across systems, Elysium I-Hub bridges gaps in technology thereby improving the efficiency and quality of patient care.

While the advantages of seamless data exchange are clear, any health exchange system must balance the drive to interoperability through standards, with practical and proven technology. Elysium's I-Hub provides this balance as a proven, easily deployed component to get the most healthcare entities exchanging information as soon as possible.

Elysium RxGateway

Elysium RxGateway provides Elysium's complete eRx solution with focus on the workflow surrounding the creation of prescriptions, refills, and renewals, as well as providing automated delivery to pharmacies. Elysium RxGateway's primary mode of delivery routes prescriptions from Elysium to SureScripts-RxHub, and from there to pharmacies. If e-delivery fails or is otherwise unavailable, Elysium Fax may automatically fax prescriptions to pharmacies.

In addition to creating and sending prescriptions, manual and automated entry of prescription refill requests is provided. Generally, refill requests arrive from two sources. The first is from a provider assistant or practice staff. These staff users are granted access to the e-prescribing component of the system, however they may only prepare and assign prescriptions for authorized physician approval, there is no ability to sign or send. The second source of refill requests is from pharmacies connected to SureScripts-RxHub. These pharmacies can send refill requests to exchange providers that are registered with SureScripts-RxHub. Upon receipt, SureScripts-RxHub will reference their provider listing, and route the refill request to the appropriate Elysium Exchange system for processing. Regardless of the source, refill requests are easily processed to provider inboxes for approval and transmission.

Beyond e-delivery of prescriptions and refill requests, there are many benefits to Elysium's RxGateway. Many Elysium HIE customers are supported financially by payers because it's understood that benefits and savings will accrue over time. These payers have worked with SureScripts-RxHub to allow provider access to patient eligibility, drug formularies, prescription fill history, and generic drug alternatives. In turn, the payer agenda is put at the physician's fingertips,

and savings are experienced across the exchange. This eligibility information may be easily populated from manual or automatic queries to SureScripts-RxHub. These queries provide real time data on patient eligibility status, thereby simplifying billing processes tied to medication management.

In addition to eligibility queries, Elysium RxGateway provides the ability to query SureScripts-RxHub for patient medication history. Responses to these queries may be saved to the patient summary medication list. Medication lists in Elysium use the NDC coding in a database populated by Medispan data. Medications can be active or inactive. Any active medications will interact with Elysium Prescription Management system. This helps avoid the prescription of any drugs that may dangerously interact with a patient's current medication. Other drug interaction warnings are displayed for drug-allergy, drug-gender, and drug-age interactions. Medication allergies are populated through data entry by Elysium EMR Lite users, from fill history provided through SureScripts-RxHub, or from CCDs obtained from external sources. Bulk data uploads from payers can also be used to initially populate patient history.

Elysium RxGateway may be interfaced with or effectively replaced by other medication gateway applications, if required.

Elysium Immunization Gateway

Elysium Immunization Gateway enables Axolotl clients to both receive and send immunization data with state registries. Elysium Immunization Gateway is designed to send and receive this data from Elysium Exchange systems, and may be tailored to meet specific statewide data specifications and regulations or requirements. First implementations of Elysium Immunization Gateway are currently being deployed within the states of Idaho and New York.

Elysium Inter-HIE Gateway

Elysium Exchange's Inter-HIE Gateway has been developed to support health information exchange across HIE systems, and are being deployed to support multi-regional workflow requirements. Elysium Inter-HIE Gateway is designed based on the standards and principles of the Nationwide Health Information Network and of smaller initiatives such as the Statewide Health Information Network of New York, as defined by IHE, HITSP, HHS, ONC, and others. As such, Elysium Inter-HIE Gateway is capable of supporting a variety of exchanges of patient data across HIEs, regardless of the HIE system in question.

Also, to support the wide variety of requirements for inter-HIE communication, Elysium Inter-HIE Gateway is capable of supporting more transactions that those recognized by NHIN. As such, Inter-HIE Gateway customers may be able to send and push data across regions (such as referrals and patient summary information), rather than just being limited to a query model to retrieve

available patient information. Axolotl's experience with NHIN demos, SHIN-NY deployment, and other statewide initiatives in the US has been integrated into Elysium Inter-HIE Gateway, allowing the component to accommodate a range of cross regional workflows and requirements.

Elysium Usage Analyzer

Elysium Usage Analyzer (EUA) provides usage, performance, access, and security reporting for activity within an exchange. Elysium Usage Analyzer references available log files of all web activity on an Elysium server. The EUA pulls data for a configurable time range, sorts it, and displays it in a number of views for reporting and analysis.
Because the EUA produces a comprehensive view of web server activity, it proves itself ideal for system performance analysis. The EUA retrieves all data related to user web requests. As such, administrators may easily break down user activities, the time it takes the system to receive web requests, and the time it takes the system to respond. This kind of data allows for detailed analysis of overall system performance, specific component performance, specific user performance, most common user activities, and more.

Beyond system performance, the EUA provides views and tools for user audit and investigation into misuse of PHI. Administrators with appropriately configured security roles may access restricted views, configure and run security audits, and view audit reports to determine what information was accessed by which user. This information can then be relayed for HIE staff to address appropriately.

Elysium Fax

Elysium Fax faxes data to physicians who may not use an EMR.
Despite the fact that Elysium Fax delivers reports by paper rather than electronically, it is still a critical part of many Elysium Exchange systems. One reason for this is that the final destination for many clinical results is still in a paper format, as many office workflow requirements include physical copies of results.

Beyond practices that require paper results, Elysium Fax allows delivery of data to entities that may not be able to receive clinical data electronically. This includes faxing prescriptions to pharmacies, faxing data to physician practices reluctant to adopt electronic solutions, and faxing data to any destinations that would be otherwise unavailable to the HIE system.

Elysium Print

Elysium Print provides ability to schedule and print batches of clinical documents for distribution or records. Every Elysium EMR Lite clinical database retains Elysium Print compatibility and

configuration pages. Configured printing options are executed by the Elysium Print Client, a small desktop application that can process documents to any connected printer.
As mentioned under Elysium Fax, the final destination for many reports remains in paper format. Elysium Print was developed to meet this workflow requirement. Every clinical database that is interfaced with the Elysium print client is automatically provided three print queues for paper workflow management.

The first print queue is for documents printed manually by users of the system. While users may print using browser and operating system print functionality, Elysium Print's manual workflow printing queue allows users greater functionality, such as printing all new inbox documents, or all documents for a particular patient. The second and third print queues are pre-configured automated queues, one for normal results, one for STAT results. Documents are automatically processed to these print queues, and print on regular schedules according to configuration settings regarding document and queue priority. Print queue preferences may be established for different users within a practice. Print queue configuration options include print days, print times, if a summary page is printed, and how printed results are sorted.

These configuration options provide clinical record management offices with tools to drastically reduce workload related to sorting, organizing, filing, and delivering paper results. In turn, a reduced workload improves workflow efficiency and reduces costs for the practice and / or community.

Distributed Gateway Components

Elysium EdgeServer

Elysium EdgeServer manages the transformation and distribution of data from systems such as legacy hospitals, lab systems, radiology systems, payers, and other regional information exchanges to Elysium. Elysium EdgeServers reside between source systems and an exchange as a collection of gateway based databases and agents. Databases include a site and feed configuration database, an administration database, a log database, and a routing database.

Accurate and efficient results delivery is paramount to the success of an exchange. Elysium EdgeServer provides all necessary recipient identification and message delivery mediums required to achieve this accuracy. Results from source systems are transported via data feeds to Elysium EdgeServers. EdgeServers then perform a number of functions, including data transformation / standardization, provider lookup, and message routing according to provider preference –
Data transformation: EdgeServer services include the ability to take incoming data and turn it into standards-based data. Elysium EdgeServer takes source systems' clinical data in a wide array of formats, translates that data into a standard format, preserves original clinical content, and produces a consistent data store. Some of the standards compatible with EdgeServer include HL7

v2.2+, HL7 v3, CDA, CCR, and CCD. Translation may include the appendage of additional standards, such as LOINC codes to an HL7 file. EdgeServers are also responsible for storing repositories of clinical data from each data source (see Elysium Repository).

Provider lookup: once data has been standardized for delivery, EdgeServer needs to know where to send it. At this point, the EdgeServer will reference the Elysium Directory (see Framework Components) for the recipient provider (providers can be found by Physician ID # or by name). Assuming a provider is found, his preferred message delivery options are applied to the results for EdgeServer delivery.

Message routing: Messages move into Elysium, throughout Elysium, and to external applications based on sets of routing rules. To every extent possible the routing of messages is automatic, based on the contents of each message. Routing leverages include the Elysium Directory for user routing choices, the Elysium Patient Index for patient identity (if recommended Patient Identity and Management services are available), and both a configuration database and a routing rules database within Elysium EdgeServer. Through these components, Elysium ensures that appropriately standardized messages are routed, according to community and physician preferences, to the physician's desktop application of choice. Available delivery options include to Elysium EMR Lite, to any CCHIT certified EHR, to a fax machine, or to a printer. As results are delivered to providers, additional copies may be sent to clinical repositories for future query.

Elysium Repositories

Elysium Repositories enable storage and indexing of all clinical data processed to an Exchange. Elysium Repositories are created and populated via incoming documents (from EdgeServer or Framework SOA based gateways) to a processing database with configurable routing and manipulation rules. Repositories typically exist on entity Distributed Gateway EdgeServers or on Elysium Framework servers across an exchange, with individual repositories for each data source. This distribution avoids commingling entity data. Alternatively, repositories may be also centrally located for performance reasons.

Typically, most patients visit a number of practitioners and have tests performed at multiple reference labs and radiology centers, even within the same geographic area. As these sources send data through Elysium, separate Elysium Clinical Repositories are created to house all data sent from each source. As described, this prevents any commingling of data from different source systems. However, the result is that a patient's complete health record becomes scattered amongst multiple clinical data vaults. These data vaults may be queried for results that are pulled to users by Elysium Virtual Health Record or other applications with appropriate web service functionality. Elysium data repositories on EdgeServers can be replicated to a central server location for performance reasons. However, it should be noted that Elysium's data repositories are much more than databases collecting clinical data. Data flowing into the repositories flows through a

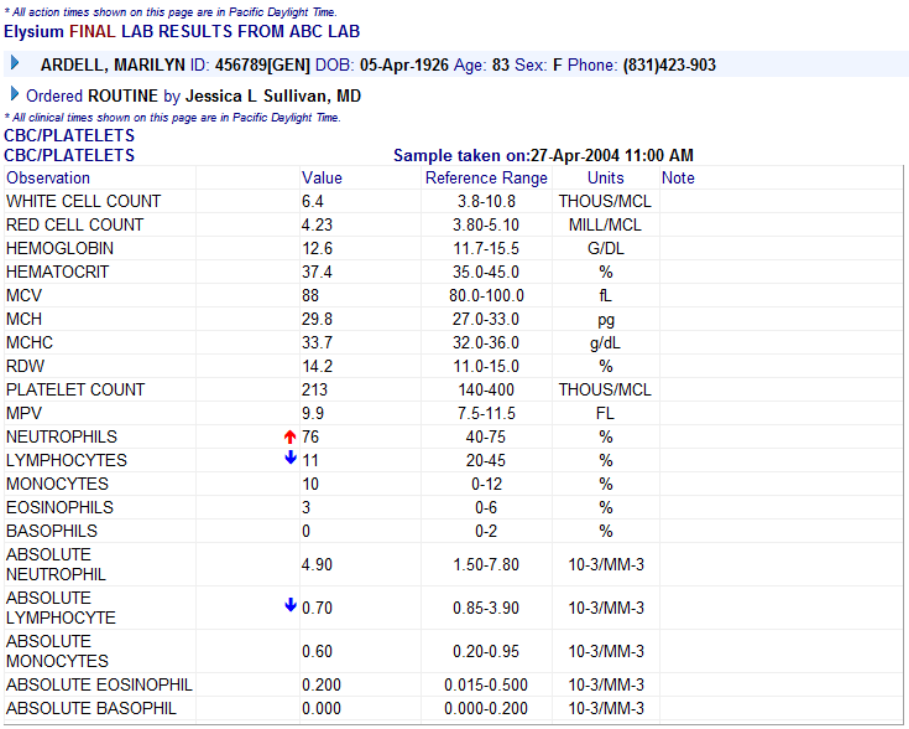
sophisticated rules engine, which significantly affects the construction of the databases and in turn the security and utility of them.

Data repositories storing entity data are typically not a single database, but rather a collection of databases organized in an efficient manner. The number and size of the collection of databases comprising the entity data is set by a rules engine. The rules engine can be configured to divide and store data by month, repository database size, data source, document type, and / or any other information available in a clinical document. Effective use of this kind of organization saves administrators time and effort. For example, if configured to create a new database each month, the repository structure enables older data to be easily warehoused without affecting current data. Elysium Virtual Health Record technology enables efficient gathering of data from these multiple databases and presents it to the user. Therefore, regardless of how the rules engine is configured for storing data, the data will always be displayed in a relevant, organized manner.
It should be noted that Elysium Repositories are XDS.b certified repositories, and may be queried using IHE XDS.b profile definitions.

End User Interface Components

Elysium Electronic Medical Records (EMR) Lite

Elysium EMR Lite is a desktop solution for clinicians that provides data creation and management features through structured, Web-enabled forms and clinical workflow processes. Databases and functionality include clinical inboxes, discussion databases, and disease reporting and rules engines. Add-ons include Elysium Ordering, Elysium Encounter Data Store, and Elysium Health Alerts (see Add-ons below). Off the shelf, Elysium EMR Lite includes components such as inbox management, clinical messaging, workflow management, referrals and consults, e-signature of documents, auto print and processing, patient summaries, and e-prescription writing.
For simple inbox management, new and unprocessed clinical messages and results are shown in the Elysium Awaiting Action view. This view appears similar to an inbox for a web based email account, and is frequently the first destination for users after authentication. Elysium EMR Lite users may manage their inboxes interactively, assign processes to agents, have certain results automatically re-routed, or choose various other options to meet workflow requirements.
To extend management beyond a single inbox, Clinical Messaging® tools are provided. Clinical Messaging® between providers is a core feature of Elysium EMR Lite. Users can create and send patient encounters, memos, referrals, and authorization requests to recipients within their practice, to Elysium users in another practice, or to other EMR users if Interoperability Services are available. Memo, note, encounter, authorization, referral, and other forms may be customized as needed. Encounter and office memo recording options are extensive and custom forms are easily generated to suit community needs. Belo



** All action times shown on this page are in Pacific Daylight Time.*

Elysium FINAL LAB RESULTS FROM ABC LAB

ARDELL, MARILYN ID: **456789[GEN]** DOB: **05-Apr-1926** Age: **83** Sex: **F** Phone: **(831)423-903**

Ordered **ROUTINE** by **Jessica L Sullivan, MD**

** All clinical times shown on this page are in Pacific Daylight Time.*

CBC/PLATELETS

CBC/PLATELETS **Sample taken on:27-Apr-2004 11:00 AM**

Observation		Value	Reference Range	Units	Note
WHITE CELL COUNT		6.4	3.8-10.8	THOUS/MCL	
RED CELL COUNT		4.23	3.80-5.10	MILL/MCL	
HEMOGLOBIN		12.6	11.7-15.5	G/DL	
HEMATOCRIT		37.4	35.0-45.0	%	
MCV		88	80.0-100.0	fL	
MCH		29.8	27.0-33.0	pg	
MCHC		33.7	32.0-36.0	g/dL	
RDW		14.2	11.0-15.0	%	
PLATELET COUNT		213	140-400	THOUS/MCL	
MPV		9.9	7.5-11.5	FL	
NEUTROPHILS	↑	76	40-75	%	
LYMPHOCYTES	↓	11	20-45	%	
MONOCYTES		10	0-12	%	
EOSINOPHILS		3	0-6	%	
BASOPHILS		0	0-2	%	
ABSOLUTE NEUTROPHIL		4.90	1.50-7.80	10-3/MM-3	
ABSOLUTE LYMPHOCYTE	↓	0.70	0.85-3.90	10-3/MM-3	
ABSOLUTE MONOCYTES		0.60	0.20-0.95	10-3/MM-3	
ABSOLUTE EOSINOPHIL		0.200	0.015-0.500	10-3/MM-3	
ABSOLUTE BASOPHIL		0.000	0.000-0.200	10-3/MM-3	

Physicians who choose to interact with the system can manage all the workflow surrounding incoming data in Elysium, obviating the need to pull charts, post notes to staff, go to medical records to sign a chart and a host of other inefficiencies. In addition, their practice EMR is available anywhere, anytime through a secure browser interface. Users can annotate and assign each message in the inbox and add workflow instructions for staff even while out of the office. Furthermore, users can configure autoprocessing rules to automatically assign, action, print, and / or route documents based on definable selection criteria (type of result, patient on result, problems on result, or any other set of results based on selection formula).

As mentioned in description of Elysium Print, many exchange users require that certain results are printed. Typically, routine results are printed in timed, sorted batches, while stat results print as they are delivered. EMR Lite provides many choices for delegating the management of reports and the timing, sorting, and selection of print batches (for more detail please see Elysium Print under Framework Components).

For medical records departments, Elysium provides an electronic signature for dictated reports. Reports can be returned directly into medical records chart completion applications with additional interface development. Other report signing and routing options may be configured as necessary.

Elysium Virtual Health Record

Elysium Virtual Health Record retrieves and displays all data available for a patient from a variety of source systems through Web enabled queries and a customizable reporting tool kit. Data retrieval and display occurs via record locator services, gateways to internal and external entities (i.e. Surescripts, external HIEs), and Web services.

A patient's Virtual Health Record (VHR) is pulled together, virtually, to create an electronic health record that contains all available patient data across the continuum of care. Elysium gathers data from a variety of sources to bring together a patient's VHR, including Web service queries to external applications, EdgeServer and I-Hub data repositories, Encounter Data Store, patient index (or indices), and any other query able data source.. A patient's VHR can include admission records, discharge summaries, visit records, medication history, problem lists, allergies, up to date eligibility information, the results of all tests and exams ordered by clinicians, and any encounter notes, referrals and orders that exchange participants are willing to share. This information is displayed similar to a patient chart, with different result types filed under different virtual tabs. In some environments, Virtual Health Record users may select data from a patient's VHR and forward selected results to their chosen EMR or EMR Lite system (this feature is dependent on source system and exchange policies and configurations).

Beyond individual patient care, Virtual Health Record administration accounts can be created to view and manage results across an exchange. These users will have access to tabs that may contain all reports that meet selection criteria across an entire community. This capability grants administrative staff the ability to easily audit and manage reports community wide. Useful examples of this feature include administrators resolving unidentified reports in repositories or viewing all recent admits or discharges for a hospital or community.

It should be noted that both user and administrator Virtual Health Record tabs are customizable. Tabs can display data based on selection criteria that may defined by complex formulas. The use of formulas allows extensive ability for tab customization to suit community, practice, and even individual user requirements.

Supporting Applications

Elysium Reporting Hub

IBM's DB2 serves as Axolotl's data consolidation platform and reporting repository - the Elysium Reporting Hub. This product enhances Elysium Reporter functionality available as part of the Elysium Exchange with data consolidation, cross-community reporting and a set of published data marts for downstream data warehousing, analytics and ad-hoc reporting.

Elysium Health Alerts – configured users can send and receive Public Health Alerts. Creators of health alerts can send alerts to all the physicians in a community, clinical workgroup, or medical field.

Elysium Ordering Gateway

Provides order entry forms within Elysium EMR Lite and a mechanism to communicate orders to a supplier using the supplier's catalog. Alternatively, order entry forms may be available within third party EMR systems, and users may export order messages (e.g. HL7 ORM message) to Elysium Ordering Gateway for appropriate translation and delivery to order suppliers Upon order completion, results are reconciled with original order details, and returned to the ordering provider in the EMR system of choice.

Elysium Referral and Order Management

Provides referral / order tracking for users and administrators within clinical databases. Users may view pending referrals, overdue referrals, or all referrals in separate views from the clinical inbox. Additionally, referral administrators can manage all referrals across a community, editing priority, status, or the default time period for overdue reports. Referral status automatically updates as the system receives and reconciles results with corresponding referrals. Users may be configured to manually update orders as necessary.

Elysium Encounter Data Store (Elysium EDS)

Enables storage, indexing, and efficient viewing and reporting on hospital patient visits and encounters. Elysium EDS is a database similar to Elysium Repository. Also like Elysium Repository, Elysium EDS is populated via a configurable processing database. Unlike Elysium Repository, Elysium EDS was designed specifically to contain and manage encounter data. This prevents the over population of other clinical databases with encounter documents. Encounter summaries are accessible from Encounter List links on the Patient Summary.

5. Core Requirements

Elysium Master Patient Index

Elysium Patient Index manages patient identity creation, matching, and record locator services. Elysium Patient Index may exist as a DB2 database rather than a Lotus Domino database. This provides certain advantages, particularly with emerging healthcare data standards. Looking forward, health information will largely be stored and shared in XML format (CDA, CCRs, CCDs). DB2 databases provide built in support for searching and organizing XML data, and are therefore ideal for patient data storage within Elysium Patient Index. Elysium Patient Index is

typically built dynamically by HL7 ADT feeds from data providers to Elysium EdgeServers. Replicas of the Elysium Patient Index may reside on EdgeServers and other distributed components of an Elysium HIE. Axolotl personnel interact with the system to configure and manage the index, or entity staff may be trained to perform system administration functions.

A first requirement of any patient index is the generation of unique identifiers for each patient. Elysium Patient index supplies an unlimited number of unique patient ID numbers. These patient IDs can be generated by two methods. The simpler, less efficient method is to add patients manually from the user interface. The interface also provides tools for configured users to edit existing patient information. Most patients in the system are added automatically; Elysium Patient Index automatically creates and assigns a unique ID to all new patients in the exchange. In order for each patient ID entry to be determined unique, a minimum data set (MDS) is required prior to adding or matching a patient. Typical minimum data sets include patient first and last name, gender, and date of birth, but MDS's may be configured to require a wide range of patient data. The index also provides automated identification and matching of patients based on demographic attributes and other identity parameters.

In addition to the IDs themselves, Elysium Patient Index provides an unlimited number of couplings to entity IDs. In other words, each patient has a unique Elysium Patient ID, with an unlimited number of source system entity IDs coupled to it. Through this coupling, Elysium Patient Index provides cross referencing services that ensure accurate patient identification for results delivery and retrieval.

This accuracy is essential for HIE users to be able to query for a patient's complete health record when parts of the continuum of care record are scattered across the community. By using source system IDs, Elysium Patient Index's Record Locator Service (RLS) ensures the retrieval of the correct clinical data, regardless of similarities in patient demographic details.
In the case of unidentifiable records for delivery that do not contain the MDS to match or create a new patient ID, the records are still delivered to their destination as unidentified. The end user may then identify the reports to an existing patient in Elysium Patient Index, or create a new patient ID by adding the necessary patient demographic data (first name, last name, DOB, sex, SS#, etc.) This process can also be used to merge patient documents in the event of duplicate entries.

As patient information is gathered, summary data may be added to the patient record in the index. This information can come from a number of sources, and may be entered manually or automatically. Potential sources of data include manual entry by end users, automated import from clinical results passing through the exchange, and data import from external systems such as medication history from SureScripts-RxHub, or CCD information from another EMR or practice management system.

It should be noted that Elysium Patient Index may either interface with or effectively be replaced by alternative EMPI products. Axolotl maintains a partnership with Initiate Systems, for example, for the integration of Initiates EMPI with Elysium Exchange services.

Data Dictionary and Vocabulary Standardization

Complete interoperability requires the use of standard terminologies across systems. This is perhaps the most difficult challenge posed to health organizations. Elysium currently makes use of many standard vocabularies including LOINC, NCPDP, CPT4 and ICD9 as well as some Elysium specific vocabularies.

The Elysium SOA platform includes an embedded terminology server to provide semantic interoperability for cross-community data exchange. This ensures that each community is able to capture coded data in its preferred vocabulary, but at the same time not losing essential interoperability during data transfer. All of the terminology server functionality is also exposed as web services. As desired, terminologies may be mapped and appended to data that is received for standardization. For example, Axolotl frequently works with lab source systems upon feed implementation, to standardize lab data with LOINC codes. This provides huge benefits, as patient and population information may easily be charted, graphed, and analyzed using a unified coding system.

For advanced semantic interoperability, Axolotl has selected to integrate Apelon DTS to manage data dictionaries and vocabulary standardization. The integrated solution enhances Elysium Exchanges vocabulary support to include SNOMET-CT, RxNorm, ICD-10, and a wide range of other terminologies.

Provider Index and Directory

The Elysium Exchange platform provides the Elysium Provider Directory which is the application in which users of the *Elysium* HIE are registered. The application enables administrators to manage records of *Elysium* Authorized Users throughout the network. It also enables the exchange of information between *Elysium* users and other applications by identifying each Authorized User uniquely with a practice and/or workgroup. The *Elysium* Provider Directory is made available to users of the *Elysium* Community-Wide Virtual Health Record (VHR) and the *Elysium* EMR Lite products for addressing and routing messages.

Standards-based

As discussed above, the Elysium Exchange platform utilizes the latest standards in different areas for a robust solution offering.

Commitment to and Experience with IHE Standards

At some point, the greater industry realized the significant value of sharing clinical data, both within and beyond individual communities, and that in order to do so, systems *must* be interoperable. To accommodate this, nationally recognized groups such as IHE, HITSP, and CCHIT, created a number of profiles and standards that will be required to exchange health data in the 21st century. Axolotl has followed these committees and workgroups closely, and has made significant effort to adhere to standards while still meeting client and provider needs across the US. As such, Axolotl has passed several IHE certifications key to interoperability and data exchange (PIX, PDQ, XDS.b, XCA, ATNA, ARR etc.), and has adapted traditional Elysium technology to be able to employ these profiles.

While Axolotl has integrated this profile technology into Elysium, most of these profiles have not been widely used in any production system to date. However, Axolotl has demonstrated this technology at IHE Connectathons, HIMSS Interoperability Showcases, in the deployment of the SHIN-NY, and in the NHIN demonstrations. Axolotl participates yearly in IHE Connectathons, and has been consistently invited to take part in the HIMSS Interoperability Showcase that demonstrates this IHE technology. At the most recent Interoperability Showcase, Axolotl's platform was widely recognized as the fastest and most stable of any vendor at the demonstration. Beyond demonstration, Axolotl's expert IHE engineers have been working diligently to develop and deploy both SHIN-NY core services and architecture. Axolotl works very closely with the NYSDOH, and is well recognized and respected throughout the state as an expert in intra- and inter-community exchange. The architecture being deployed for the SHIN-NY is similar to that of the NHIN, and makes heavy use of interoperability profiles to exchange data across. Finally, Axolotl has played a significant role in the NHIN demonstrations. Two of Axolotl's customers, the Santa Cruz County RHIO and Quality Health Network, demonstrated clinical exchange in the first NHIN prototype demonstration in 2007. In 2008, three Axolotl customers, HealthLINC, HealthBridge, and HEALTHeLINK participated in the NHIN demonstrations. All three participants demonstrated all NHIN core services for clinical data exchange across the network. Additionally, HEALTHeLINK went further to demonstrate the ability to query HIEs both connected to and separate from the NHIN, and to query the National Pharmacy Information Network for data such as pharmacy benefits, medication history, and allergies.
This trial implementation technology was a natural extension of Elysium technology. Axolotl has incorporated these inter-HIE services into its platform to further support the clinical community, nationwide. As the NHIN architecture continues to be refined, Elysium Exchange services are expanded to meet all NHIN requirements.

Key IHE Profiles and Profile Support

With regard to the key IHE profiles for interoperability listed in the RFP (CT, ATNA, EUA, PIX, PDQ, XDS.b, and XDS-SD), Elysium Exchange supports and has been certified for all profiles but for EUA and XDS-SD.

With regard to EUA, Elysium Exchange utilizes industry standard, recognized security standards and protocols (as defined and mandated by NIST, CCHIT, ONC, etc.) for user / system authentication and authorization. However, Axolotl has not specifically prescribed to IHE's standards for EUA. As such, Elysium Exchange is not certified for EUA, but provides equivalent security functionality through integrated authentication and authentication tools.
With regard to XDS-SD, Elysium Exchange has not been certified for this profile specifically. However, as Elysium Exchange has been certified for XDS.b registry and repository, this suggests the platform can support XDS.b transactions to exchange a variety of content, including scanned images. Elysium Exchange's XDS.b functionality is fully capable of transferring scanned image data, and may be fine tuned to support the XDS-SD profile specifically, if required.

Additional Profiles

Axolotl considers at least three more IHE profiles as significant and relevant with regard to functional, efficient, and secure HIE. First, there's IHE Audit Record Repository. Audit Record Repositories provide a logs of IHE profile utilization, and the ability for users with appropriate access to perform audits for the profiles employed and the data exchanged. ARRs are critical with regard to ensuring appropriate security and privacy measures are met; without ARRs, it may be difficult or even impossible to notify patients of PHI that has been accessed (in accordance with HIPAA, ARRA, and other privacy based regulations).

Second, Axolotl considers IHE NAV a profile of significant value. Axolotl has long practiced the ideology that whenever possible, data should be "pushed" or delivered to end users. This practice alleviates the requirement of end users to query for data every time it is needed, as data is delivered directly to the end users application or format of choice (e.g. Elysium EMR Lite, other EMR systems, paper). However, the majority of IHE interoperability profiles practice the "pull" ideology, where users must initiate searches to retrieve available patient data. The NAV profile is an exception to this, as NAV messages may be "pushed" to end users to notify them of available data. Users may still have to initiate a query for data retrieval, however they are at least made aware of the presence of data, instead of having to arbitrarily initiate data queries.
Third, as previously described, Axolotl considers the IHE DSUB (formerly PUBSUB) profile to be potentially valuable to HIE. Through DSUB, users will be able to subscribe to automatically receive specific data as it is published. So, for example, a user may subscribe to a specific patients' data through DSUB, and as data is published for that patient, the data will automatically be retrieved as a result of the subscription. Utilization of this profile will also alleviate the need for users to arbitrarily query for patient data, as described for the NAV profile above..

Maintenance of certification and standards compliance

As standards and certifications continue to evolve, Axolotl continues to follow and participate in relevant standards workgroups, including but not limited to HL7, CCHIT, IHE, HITSP, HHS, and ONC.

Axolotl commits to meeting a variety of certifications and standards as developed and mandated by the aforementioned workgroups. This level of support for recognized standards and certifications ensures that Elysium Exchange is an HIE platform capable of providing cutting edge systems interoperability, as required to meet upcoming ARRA requirements.
Please see the top of this section, IHE Integration Profiles for a description of Axolotl's participation in IHE Connectathons, NHIN demonstrations, and deployment of state of the art Statewide Health Information Network technology.

Connectathon Results

With regard to connected system names, it is quite difficult to be certain of all systems Elysium Exchange connected with at Connectathons over the past several years. However, as exchanges using IHE interoperability profiles are standards based, it can be stated that the following vendors have likely interfaced with Elysium Exchange at Connectathon(s).

- Agfa
- Alert
- Allscripts
- Blueware
- Digichart
- Eclipsys
- Epic
- GE
- Greenway
- Healthvision
- IBM
- ICW
- Initiate
- Intersystems
- McKesson
- Microsoft

- Mysis
- NextGen
- Oracle
- QuadraMed
- Sage
- Sun Microsystems and Vangent (allied)
- SWPartner
- Wellogic

With regard to describing the data connections and integration types, all data connections were based on the IHE profiles being utilized and certified. To date, Axolotl has been certified for PIX, PDQ, XDS.b, XCA, CT, ATNA, and ARR. Exchanges were made based on each of these profiles. From a technology standpoint, these Web service based connections at Connectathon performed both secure (SSL / TLS) and unsecure exchanges of SOAP messages over HTTP.

Security

Secure network connections and protocols are responsible for the transfer of PHI into and outside of the network. Web standards such as VPN tunnels, WANs, SOAP, HTTPs, and sFTP greatly reduce the threat of third party interception of sensitive data. For data transfer to Elysium U/I end users, SSL encryption is utilized to encrypt any data going to Web browsers for display. For web services, secure network transport is provided by WS-security components such as SAML, the X.509 token profile, XML encryption, and XML digital signature.

Enhanced internal security is provided through key encryption on all data that passes through each server's transfer ports. This encryption makes intercepted data useless to offenders for lack of an appropriate decryption key. Further platform security is provided by the IBM Domino Directory (the host of the Elysium User Directory). The directory provides administrators with user role and user workgroup creation, configuration, and administration tools. When users access the system, configured roles and workgroups are cross checked against database Access Control Lists (ACLs).

Beyond ACLs, Elysium databases are configured such that each user may only see certain views, forms, fields, and documents based on user type. If necessary items aren't defined on a user document, the system will compute not to provide or display certain information or options in the Elysium EMR U/I. This strengthens Elysium's ability to prevent unauthorized access to PHI by disabling the provision or display of it.

Elysium Exchange security policies are highly flexible, to support a variety of regulations and requirements, even within a single HIE deployment. The degree to which configured policies affect a given end user is very closely related to the level of integration of that end users system with the Elysium Exchange platform. For example, an EMR user who is simply receiving results from the exchange network will not be greatly affected by most system policies. However, a provider who interacts closely with the network through tightly coupled Web service integration may be subject to higher degrees of policy restriction / regulation (e.g. policies for minimum data set for patient record retrieval, policies for patient consent).

Elysium Exchange system policies are highly configurable, and may be easily deployed to apply different policy configurations to different sets of users within the greater exchange population. This flexibility is critical for Elysium Exchange networks that either consist of multiple (potentially competing) stakeholders, or for networks that span across state or regional boundaries. Through these policies, Elysium Exchange is easily deployed to meet a wide variety of provider workflows and business needs.

Flexible

As discussed above, because the Elysium Exchange solution is based on a SOA-architecture, various native applications can be integrated over time as sources of patient data as the HIE grows over time. In addition, because of its web service architecture, various external systems/applications can be integrated using plug-ins or gateways.

6. Other Features

Quick Speed to Value

The Elysium Exchange solution set strongly supports health system communities, and enables all facets of the continuum of care to create, view, manage, and exchange data. Hospitals and data sources can seamlessly provide results to their affiliated providers, and may receive and track orders from these providers through Elysium's electronic ordering modules. Providers may easily communicate with each other, regardless of whether they employ a specialty EMR system or require a cost effective light weight solution such as Elysium EMR Lite. These same providers may also have access to a patients community wide health record, either through Elysium Virtual Health Record or through their Web service enabled EMRs. Complete medication management services may be provided, with delivery of prescriptions and receipt of refill requests, and query services for medication fill history and PBM data. Providers and patients may connect and collaborate through Elysium PHR Gateway, enabling greater levels of patient understanding, control, and participation in the care process. Hospitals within the system may feed their data to reporting systems and health agencies, allowing for analysis and reporting on community wide conditions and the effectiveness of treatment. Finally, Elysium Exchange can enable nationwide

data exchange of all the clinical data types that pass through the individual HIE system, making clinical data available as needed, across the US.

These solutions have been deployed and hardened across Axolotl's single system and multi-stakeholder environments (listed above), and can be implemented to provide MHS stakeholders, providers, and patients with tools for state of the art data access, exchange, and analysis. Axolotl would be proud to deploy Elysium Exchange for the Arkansas Health Information Exchange, making patient data available to the health system community, when and where it is needed.

Hosting Environments

Axolotl typically provides Elysium Exchange as Software as a Service (SaaS). As such, Axolotl tends to host all Elysium Exchange hardware, and provides implementation, operations, maintenance, and support services for clients on an ongoing basis.

Axolotl only hosts production Elysium Exchange servers in Tier 4 data centers that can pass the internationally recognized SAS 70-II standard requirements. This includes physical precautions such as HVAC units, fire retardant measures, strict host and guest authentication / sign in policies, biometric access controls, and more. Axolotl currently hosts Elysium Exchange servers in two data centers; XO Communications in Silicon Valley, CA, and Level 3 Communications, in Baltimore, MD.

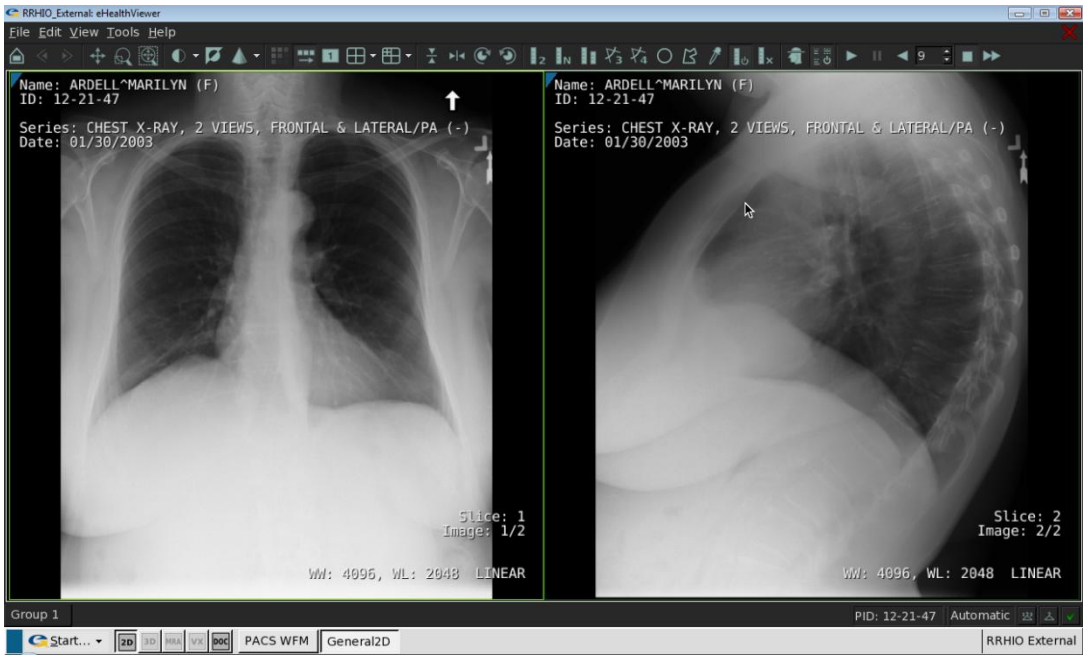
Axolotl's proven implementation approach enables the fastest possible deployment and highly secures HIE operations. While Axolotl can optionally deploy software in customer data centers and locations, this is not generally proposed for a variety of reasons. One of the more compelling reasons is cost, as leveraging the Axolotl data centers' infrastructure enables not only quick installation and configuration, but also achieves economies of scale for hardware and network infrastructure. Yet another advantage to an Axolotl hosted solution is Axolotl's streamlined installation approach, which has been hardened over a many rapid implementations. Finally, the solution proposes to have each data center contain complete working versions of the applications and up to the second replicas of the data, enabling full redundancy of the HIE to protect against a natural disaster or other unforeseen calamity.

Eligibility and Authorization Unification

Elysium Exchange may initiate patient benefits eligibility queries from various pages of the application. The eligibility query utilizes standard ANSI X12 270 / 271 messages, and as such should be compatible with the majority of payer systems (including Medicaid / Medicare) for eligibility query.

Value-Added Services: Radiological Image Exchange (Optional)

Axolotl provides an additional service called Image Exchange which provides end-users to view high resolution DICOM images from multiple PACS systems through a single, unified viewer. There is an additional charge for the add-on module.



Appendix A

Company Information

Axolotl Corp. (full company name), a San Jose, CA based company, has been providing web-based Health Information Exchanges (HIE) services to communities, hospitals, and large health systems since 1995. Since inception, Axolotl has continuously expanded clinical collaboration and data management offerings to meet the diverse and changing needs of today's health care communities. As a result, Axolotl is widely recognized and acclaimed throughout the HIE industry. This reputation has helped establish Axolotl as the undisputed leader in state and regional level HIE clients.

Axolotl has always been dedicated to meeting the needs of healthcare, primarily by connecting the ambulatory care healthcare IT market with each other and the institutions with whom they work. Since 1995, the market for HIE products and services has evolved substantially, and Axolotl has led the market throughout this evolution. Axolotl has more customers using the Elysium Exchange HIE platform than the next three competitors combined.

The changing needs of the market make it quite unique – interoperability and health information exchange are still relatively adolescent fields. This lack of maturity contributes to a wide variety of market needs that require more complex solutions than typical business models. Axolotl's Elysium Exchange suite is driven by these market needs, and as such continues to meet and surpass the requirements of today's health exchange systems.

In addition to the relative immaturity of the HIE market, diversity within the ambulatory care market also contributes to the need for flexibility in HIE solution sets. This diversity can be seen in specialty versus primary care providers, in early adopters versus technophobes, in very small versus very large clinic practices, and in healthcare organizations that accommodate a wide range of adoption levels and slow-to-evolve legacy systems. With this diversity, the goals of the healthcare market demand a wide range of solutions, from results delivery, to sharing of community wide health records, to public health disease reporting, to clinical data repositories, to medication history reconciliation, and beyond.

To continue to meet the goals and needs of this diverse market, Axolotl has enhanced the Elysium Exchange product suite and expanded its professional services steadily since the company's inception. This started with Clinical Messaging® products in 1995, and in the time since Axolotl's offering has become a fully web based application suite that includes e-prescribing, e-ordering, mobile support, integrated transcription, SureScripts eRx integration, patient identity services, chronic disease registries, SureScripts (advanced) and RxHub certifications, IHE certification and Web services for inter-HIE exchange (NHIN), CCHIT EHR certification, and more.

There have been many challenges on the path to successful sharing of healthcare information and systems (EMR, HIS, LIS, etc.) interoperability. Axolotl has navigated customers through these challenges, and can help other health organizations achieve the same goals. Axolotl has established and will maintain leadership in the HIE market, connecting health systems and government agencies, lowering costs, and providing complete patient healthcare information, when and where it is needed.

Axolotl would be proud to add the Arkansas Health Information Exchange to the list of Elysium Exchange powered, successful HIEs.

Office Locations

Axolotl's headquarters are located in San Jose California, with smaller sales, support, and client services offices located across the US. Currently, Axolotl employees work out of offices in California, Utah, Colorado, Texas, Ohio, Pennsylvania, and New York.

Axolotl's current service area is domestic, serving clients throughout the U.S. Despite this domestic focus, Axolotl is evaluating international requirements for HIE, and plans to integrate multi-lingual and international standards support within Elysium Exchange in future releases.